Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

Reserve
aHC103
.7
.A245

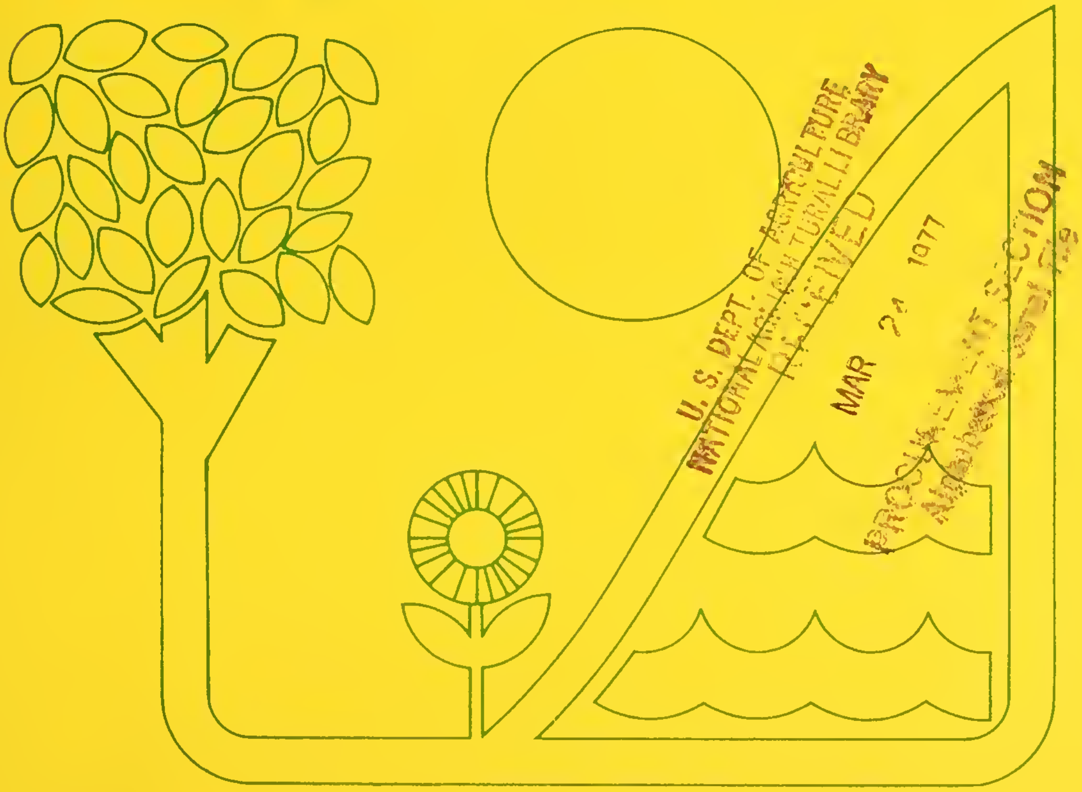
FOR DISCUSSION ONLY

WORKINGPAPER

NRE

ECONOMIC
RESEARCH
SERVICE

UNITED STATES
DEPARTMENT OF
AGRICULTURE



U. S. DEPT. OF AGRICULTURE
NATIONAL AGRICULTURAL LIBRARY
RECEIVED
MAR 24 1977
PROCUREMENT SECTION

684318

WORKING PAPER SERIES

NUMBER 8

TITLE PENNSYLVANIA ANALYTICAL SUMMARY: AGRICULTURAL ECONOMY AND PROJECTIONS

AUTHORS JOHN E. HOSTETLER,
SUSAN B. MIDDLETON &
MARK A. HELMAN

DATE July 1976

FOR DISCUSSION ONLY

Natural Resource Economics Division
Economic Research Service
U. S. Department of Agriculture
Washington, D.C. 20250

TABLE OF CONTENTS

Page No.

CHAPTER I. INTRODUCTION 1

Objectives and Scope 3

Approach 4

Historical Setting 4

General Projection Methodology - Agricultural Production 4

Population Projections and Distribution 4

Economy and Employment 5

Agricultural Water Use 5

Land Use 5

CHAPTER II. ECONOMIC DEVELOPMENT HISTORY OF PENNSYLVANIA 7

CHAPTER III. GENERAL PROJECTION METHODOLOGY - AGRICULTURAL PRODUCTION 25

Basic Assumptions 25

Methodology 28

Shift-Share Analysis 29

Spillman Projection Function 33

Agricultural Production 37

Crop Production 37

Livestock Production 42

CHAPTER IV. POPULATION PROJECTIONS AND DISTRIBUTION 46

Total Population 46

Population Distribution 48

Projection Procedure 49

Farm Population 51

Page No.

Urban Population 54

Rural Nonfarm Population 56

CHAPTER V. EMPLOYMENT 59

Projection Procedure 59

State Planning 59

OBERS 60

Comparison of Results 60

Projections by Industry 62

The Agricultural Sector 66

CHAPTER VI. AGRICULTURAL WATER USE 69

Irrigation 69

Livestock Water Use 72

CHAPTER VII. LAND USE 77

Current Land Use 77

Projected Land Use 78

Urban Land 80

Cropland 81

Pasture 83

Forest and Other Land 83

APPENDIX A. HISTORICAL SETTING BY SUBREGION

APPENDIX B. TABULAR DATA

LIST OF TABLES

Table No.		Page No.
1	Average market weights, livestock and livestock products, target projection years	43
2	Total population, historical and projected numbers by subregion	50
3	Rural farm population, historical and projected numbers by subregion	55
4	Urban population, historical and projected numbers by subregion	57
5	Rural nonfarm population, historical and projected numbers by subregion	58
6	Historic and projected labor force and employment, Pennsylvania	61
7	Historic and projected employment by industry, state of Pennsylvania	63
8	Historic and Projected employment by industry, State of Pennsylvania	65
9	Historical and projected number of full time farm employees per year	67
10	Current and projected irrigated acreage by subregion	70
11	Irrigation, historical and projected acreage by subregion	71
12	Estimated daily water usage by livestock class	73
13	Current and projected livestock water use by subregion	75
14	Historical and projected livestock water use by subregion	76
15	1974 land use distribution by subregion	79
16	Current and projected urban land use by subregion	82
17	Total Cropland, current and projected by subregion	84
18	Pasture, current and projected acreage by subregion	85

LIST OF FIGURES

Fig. No.	Title	Page No.
1	Study Area	2
2	Early treaty and settlement patterns	10
3	Example of constant share	31
4	Example of changing share	32
5	Ceiling value set	35
6	Logarithms of difference computed	36
7	Logarithms of differences projected	36
8	Antilogarithms taken and projection values obtained	37
9	Projection of production and acreage by crop	39
10	Projection of subregion production	40
11	Projection of subregion yield	40
12	Derivation of subregion acreage	41
13	Projection of livestock numbers	44
14	Comparison of OBERS Series C and E population projections with state projections	47
15	Projection of farm population	52

ABSTRACT

Under a liberalized interpretation of the U. S. Department of Agriculture's Type IV River Basin Program a study was made to provide input data to the Pennsylvania State Water Plan. Only specified inputs were requested of the Economic Research Service. They included: brief historical settings for each of twenty subregions; an evaluation of State population and employment projections in addition to providing rural breakdowns of each; an assessment of State estimates of livestock numbers, irrigated acres, and associated water use; and estimates of current and projected major land use.

To accomplish the above, OBERS projections of agricultural activity at the State level were disaggregated to the subregion level. The report documents the methodology used in accomplishing the entire work effort and presents relevant results, but draws no conclusions.

KEY WORDS: Methodology, projections, land use,
Pennsylvania, population, employment.

PENNSYLVANIA ANALYTICAL SUMMARY: AGRICULTURAL ECONOMY AND PROJECTIONS

By

John E. Hostetler, Susan G. Middleton, & Mark A. Helman*

CHAPTER I. INTRODUCTION

The State of Pennsylvania, through its Department of Environmental Resources, is in the process of formulating a State Water Resources Plan. They have requested the assistance of three USDA agencies (the Soil Conservation Service, Forest Service, and Economic Research Service) to provide specified inputs to their Plan.

The USDA will be contributing to the State Plan through the Pennsylvania Analytical Summary, a Type IV River Basin Study. This report by the Economic Research Service brings together in one document the contributions of that agency to the overall study.

All sixty-seven of the State's counties and parts of six major river basins are included in the study area (Figure 1). For analysis and report purposes counties were disaggregated and recombined into twenty subregions along hydrologic boundaries.

---

*John Hostetler is an Agricultural Economist, and Susan Middleton and Mark Helman are former Economists, with the Northeastern Resource Program Group, Natural Resources Economics Division, Economic Research Service, USDA, located in Broomall, Pennsylvania.

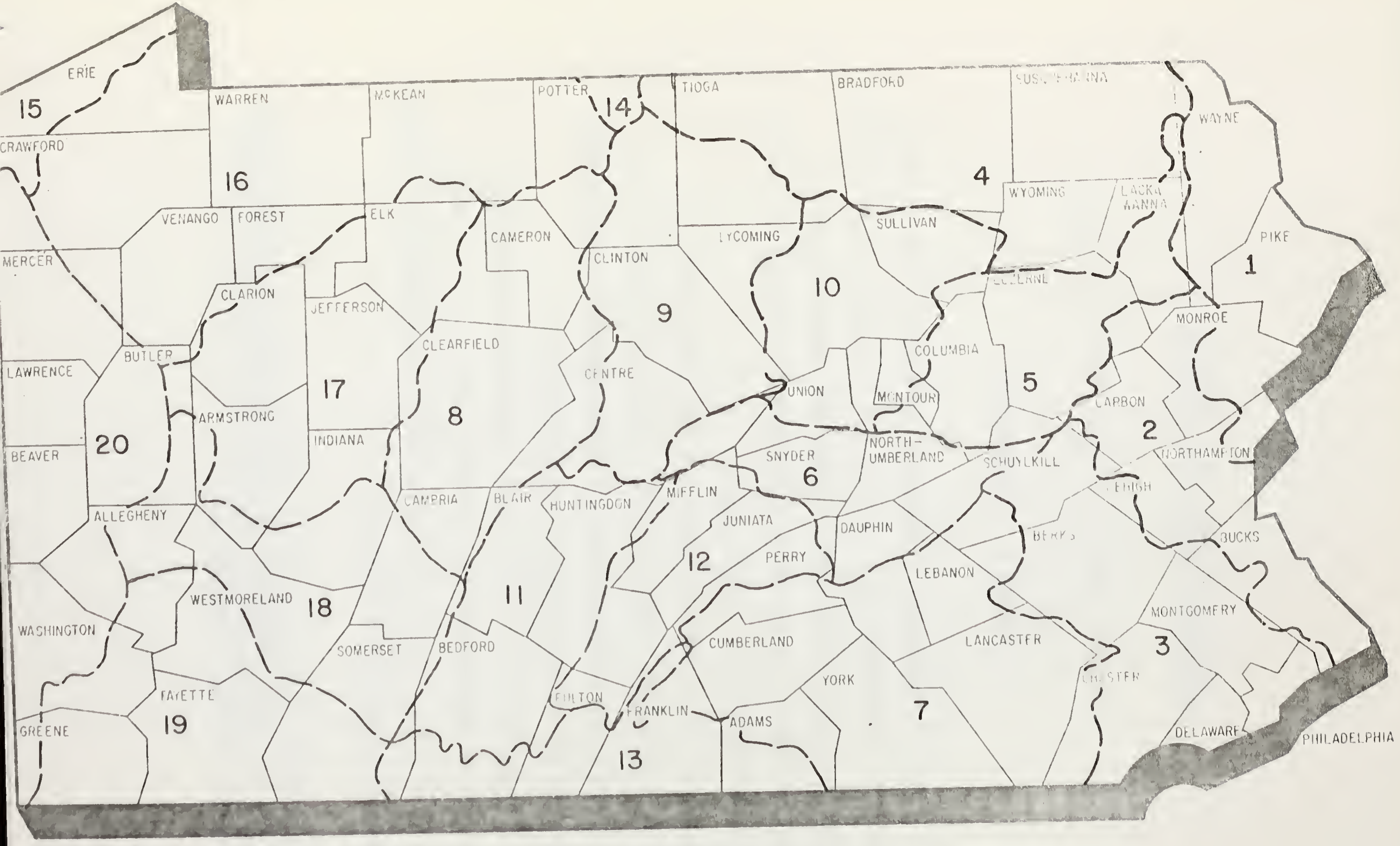


Figure 1. Study Area

There is a real diversity in major land uses included in the study area. Pennsylvania's 45,300 square miles consist of 57.5 percent forest, 21.5 percent cropland, 8.6 percent urban, 6.1 percent pasture land, 0.5 percent water area, and 5.8 percent other land.[1/] The mix of land uses also varies substantially among subregions. Pennsylvania is a highly diverse state with important sectors of the economy including: agriculture, forestry, heavy industry, mining, and all types of manufacturing. From a national perspective, the state produces nearly all the buckwheat, cigar filler tobacco, a major share of United States mushrooms, and leads the nation in atomic power generation. The oil industry had its beginnings in Pennsylvania and the state is still a prime source of lubricating oil. Vast hardwood timber resources support existing industry facilities and contribute to the state's second ranking as a hardwood lumber producer.

Objectives and Scope

The objectives of this report are to briefly describe the development and settlement of Pennsylvania; analyze and project historical and future agricultural production, population, employment and water use; and estimate future land use changes. Results are tabulated, analyzed, and compared with state projections on the basis of twenty hydrologic subregions as identified and delineated by "Areal Components of the Hydrologic Units of Pennsylvania with a Political Subdivision Index."

This approach utilized OBERS[2/] projections of agricultural activity at the state level for the years 1980, 2000, and 2020. These totals were distributed among the subregions based upon historical and projected county shares of state production as detailed in the chapter on projection methodology.

[1/] Pennsylvania Conservation Needs Inventory, 1967.

[2/] Office of Business Economics and Economic Research Service. From "unpublished material supporting the agricultural portions of the Water Resources Council's 1972 OBERS projections," USDA, ERS, NRED.

Approach

The basic approach of this study was to utilize as much secondary data of a water use nature as possible. Included were various river basin studies (encompassing portions of the state), state agency publications, and Water Resource Council projections of economic activity. The order and contents of each succeeding chapter are summarized below. Specific methodology behind each aspect of these projections is discussed in the appropriate section.

Historical Setting

This chapter presents a summary of the twenty subregion reports grouped on the basis of similarity in settlement patterns. The individual reports are found in Appendix A. They include a brief description of historical settings of the current residents in each subregion. Identification is made of socio-economic conditions which influenced particular subareas to develop differently from others and also influenced their use of water resources. Applicable river basin studies, state agency publications, and Pennsylvania histories were reviewed.

General Projection Methodology - Agricultural Production

This chapter outlines the basic assumptions underlying the projection methodology, explains the combined use of Shift-Share analysis and Spillman function, and reports current production and projections in tabular form on the 1980, 2000, and 2020 time frame. Future agricultural production at the subregional level becomes the basis for the agricultural components of later chapters.

Population Projections and Distribution

Department of Environmental Resources projections of total population and its subregion distribution were reviewed. Total population projections were evaluated and disaggregated into farm and nonfarm components. In addition to river basin, regional commission, and university data sources, heavy reliance was placed on data developed from the agricultural projections which were the base for most of the study items in this and subsequent chapters.

Economy and Employment

This chapter describes and disaggregates current and projected future trends in employment with particular emphasis on rural and urban relationships. Office of State Planning data are evaluated against projections made by appropriate river basin studies, Appalachian Commission, and private regional studies.

Agricultural Water Use

In this chapter Department of Environmental Resources projections of irrigation and livestock water use were evaluated in relation to the projected agricultural economy. Historical shares of agricultural activity were developed by county and projected relative to OBERS state level projections. The counties were converted to parts of subregions, and livestock numbers by class were related to state livestock number projections. An assessment was made of state estimates of future irrigated acreage by subregion in view of disaggregated OBERS crop production and subregion trends in irrigation.

Land Use

In cooperation with the Soil Conservation Service and Forest Service, past and current land use data were developed using 1967 Conservation Needs Inventory (CNI) data and updating it to 1974. Projections were made of agricultural crop and livestock land requirements, urban and related uses of land, and, in cooperation with the above agencies, major land use estimates were reported by subregion. Data sources were the Census of Agriculture, CNI, and pertinent river basin studies.

CHAPTER II. ECONOMIC DEVELOPMENT HISTORY OF PENNSYLVANIA[1/]

The development history of Pennsylvania has been shaped by its landscape, early government policies, and by its vast natural resources. Land acquisition through Indian treaty enabled peaceful settlement to occur while natural waterways provided access to the new land. Agriculture was the economic base of the first settlements but was soon supplemented by the manufacture of iron products, forged into tools and implements necessary for farming and settlement. Small forges and furnaces were erected by the settlers not long after they constructed their first gristmills and sawmills. Iron ore was abundant, the forest furnished charcoal for fuel, and the streams supplied water power.

At the extreme southeastern corner of the state is the Atlantic Coastal Plain with the Delaware River as a pathway to the Atlantic Ocean. Here, William Penn found desirable land for the first settlements and the first industry. This physiographic province occupies the area between Philadelphia and South Mountain near Reading and from there south and west to Maryland. Its low rolling hills and broad valleys were rich in limestone and agricultural potential. This limestone country provided room for a rapid expansion of settlement from the farming fringes of the Delaware into central Pennsylvania. It also had the iron deposits and limestone which were the basis for an early iron industry that produced the tools and implements so necessary to colonial America.

North and west of the Piedmont is the ridge and valley region comprising one-third of the state; a key part of this area is the Great Valley which furnished a pathway for people to move south and west. It reaches from the

---

[1/] See Appendix A for subregion reports on Historical Development.

Delaware River westward to the Susquehanna and then south and west through the Cumberland Valley toward the Shenandoah Valley of Virginia. East of the Susquehanna, the Great Valley is known locally as the Lebanon Valley and west of the Susquehanna it is the Cumberland Valley. Unlike most valleys, this one was not formed by a river. Actually, the Susquehanna River cuts through it by way of an interfering South Mountain ridge on its way to the Chesapeake. This is also limestone, iron ore, and coal country.

The great Appalachian plateaus stretch all the way from New York to Alabama across Pennsylvania. In Pennsylvania the region is called the Allegheny plateau and covers almost two-thirds of the state. In western Pennsylvania the plateau is higher and the area is frequently called the Allegheny Mountains. Northern Pennsylvania is part of this region along with northeastern and north central Pennsylvania. Here are the stores of hard and soft coal, natural gas, and petroleum. Although rich in resources, to the people moving west these mountains were a barrier which had to be surmounted consuming much time and effort. And, finally, in the extreme northwest is the narrow, fertile Coastal Plain along Lake Erie, which provides Pennsylvania with a port on the Great Lakes.

Although the real history of Pennsylvania begins with the founding of the Quaker commonwealth by William Penn, its preliminaries are found in the earlier explorations and settlements along the Delaware River. As the rivers formed natural highways for early settlers, it was prudent that forts and towns were located on river banks.

The Dutch first explored this region in 1616, but were followed by the Swedish who farmed and settled the Chester area in 1638. These first settlements provided a foothold in the New World so that when William Penn arrived in 1682 there were approximately 1,000 settlers in the region. These settlers had begun shipbuilding, barrel making, and operating a gristmill powered by the waters of Cobbs Creek.

Penn established his settlement of Philadelphia at the juncture of the Schuylkill and Delaware Rivers. This location proved to be most advantageous as the Schuylkill River provided access to the rich farmland in the interior and the Delaware River provided a deep water port allowing Philadelphia to become a major shipping center. Within a generation after the coming of William Penn, the characteristics of a frontier community had vanished throughout the region. Philadelphia developed a thriving trade and many businessmen grew rich from foreign commerce. Shipbuilding and manufacturing flourished so that the Quaker city became a prosperous community and a cultural center. The rural districts with their fertile farmland and abundant iron ore also prospered.

William Penn recognized the importance of securing the Indians' consent to his occupation of the country. Purchases of Indian claims to land were at first transacted with the Indians occupying the territory in question. After the early period all dealings were carried on with the Iroquois who ruled over the Indians of Pennsylvania. Penn and his agents negotiated numerous land transactions during the early history of the province, but the amount of land acquired in his lifetime was relatively small.

Since many of the boundaries given in the early treaties were vague, a large purchase was made from the Delawares in 1718, covering all previous acquisition of land in the southeastern portion of the province from the Delaware and Susquehanna Rivers to the Lehigh hills. For the most part, westward migration coincided with the purchase of the Indians' land (as shown in Figure 2) for two basic reasons: first, pioneers that settled on Indian lands were attacked and massacred; and, secondly, it was difficult to hold a legal claim to the land until areas were formally opened up to settlement. In spite of the danger and uncertain claims to land there was some westward migration but it was not on a large scale.

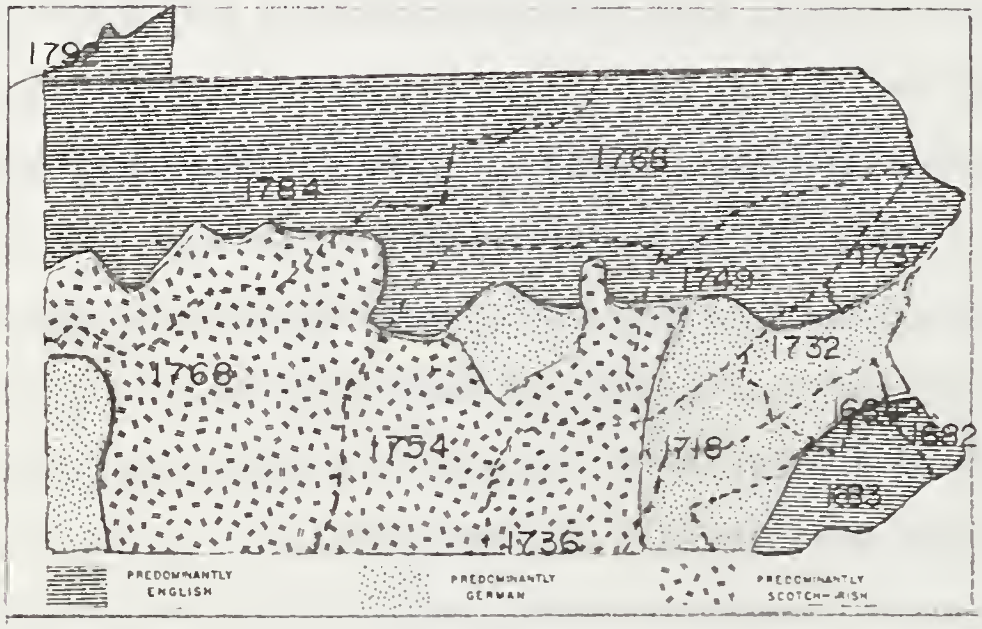


Figure 2. Early treaty and settlement patterns

Adjacent to the Philadelphia area, and as a natural outgrowth from that city, settlement came to the Cumberland, Lebanon, Lancaster, and York valleys after the treaty of 1718 was signed. The first county formed outside the three original counties of Philadelphia, Chester, and Bucks was Lancaster, which was carved from Chester County in 1729. This outward thrust of population from the lower Delaware followed an overland route long developed by the Indians for trade and communication to the northwest, the old Minqua path. The movement of early settlement was in this direction rather than up the valleys of the Delaware or the Schuylkill. Population grew rapidly in this region; as a result the Penns laid out the town of Lancaster in 1730, which soon became the great inland town of the colonial era. This was remarkable because, unlike most early towns in colonial America, it was not on a waterway but maintained contact with the sea via Philadelphia by overland travel.

Early settlement occurred here because the valleys were rich in limestone and were ideally suited to farming. The first to settle and farm the area were members of persecuted sects that had emigrated from Germany for religious reasons. The most numerous of these groups were the Mennonites and Amish who were the pioneers in Lancaster County. A later mass immigration of Germans began in 1727, and continued until the Revolution. The second wave were predominately church people, as the Lutherans and the German Reformed were customarily designated to distinguish them from the sects that comprised the earlier immigration and worshipped in each others homes.

The Germans were among the most successful farmers in the colony. In general, they owned the best lands, worked their farms industriously, took great care of their livestock, and had excellent barns and fences. It was they who developed the Conestoga horse and the Conestoga wagon. These wagons carried large quantities of flour to Philadelphia from the interior, especially from Lancaster. On the whole, Pennsylvania German land was the most productive agricultural region of colonial America.

Gradually, settlers moved westward and across the Susquehanna River. In 1736, a treaty of purchase was made with the Iroquois for a tract of land enclosing the area already ceded and extending its limits to include about one-sixth of the present area of Pennsylvania. Thus, by 1741, the town of York was laid out and York County was established.

In 1749, another purchase was made from the Iroquois for a tract reaching from the Delaware to the Susquehanna (including the present Pike, Monroe, Carbon, Schuylkill, and Dauphin Counties) and lying to the north of the previous purchase. Also in 1749, a year after York County was created, Cumberland County was formed as the Scotch-Irish pushed into the broad valley of the same name.

Most of the early settlers were engaged primarily in farming, transportation, and mining in that chronological order. These activities depended upon the rivers, as they were vital carriers of both people and goods and, thus, shaped the course of settlement. The rivers were even more important as a source of power for the machinery of the saw and gristmills. Farm products raised in the Susquehanna Valley found a convenient market in Baltimore, which was accessible easily by transportation down the Susquehanna River and its tributaries. Some of the products were also shipped by a mixed land-and-water route to Philadelphia.

Immigration into the province continued at a rapid pace. Between 1717 and 1776, approximately 250,000 Scotch-Irish came to colonial America from Ulster in northern Ireland,[1/] and most came to Pennsylvania. The English and the Germans had gained possession of the choice land in eastern Pennsylvania by the time the Scotch-Irish began to arrive in large numbers and, thus, they sought the farthest frontiers for settlement. By a treaty with the Iroquois at Albany in 1754, a large region to the west of the previous purchases was secured. Later, because of troubles arising with the Indians over the Albany purchase, this treaty was repudiated, and in 1758, a new deed was signed surrendering part of the purchase of 1754 and

---

1/ Sylvester Stevens, Pennsylvania: Birthplace of a Nation (New York, 1964), p. 66.

confirming new boundaries. By the land purchase of 1758, the proprietaries acquired a large tract of land lying west of the Susquehanna and extending to the southern boundary of the province, in the foothills of the Alleghenies. It was here the Scotch-Irish settled.

Many of the Pennsylvania frontier forts during the Revolutionary period were located in south central and central Pennsylvania. Fort Loudon, for example, was settled before 1756, when a crude fort was erected by Colonel John Armstrong and named for the Earl of Loudon, who for a brief period commanded the British forces in the Colonies.

Nearby, the Conococheague Valley served as a buffer between Indian country and the more densely settled sections. During uprisings, however, the full force of Indian anger was directed against remote settlements in the Valley. Pioneers erected cabins, cleared land, and tilled their fields under constant threat of Indian attacks which, when they came, had to be repulsed with little or no aid from the King's forces. Philadelphia merchants aggravated matters by sending westward train after train of pack horses laden with trinkets, knives, guns, ammunition, and rum to be traded with the Indians for furs.

An incident at Fort Louden, ten years before the Battle of Lexington, reveals the growing spirit of revolt in the American colonies. The homesteaders took the law into their own hands in 1765, less than a year after a band of Indians had killed nine children and a schoolmaster. A pack train traveling to the Ohio Forks under the protection of the British was raided by the settlers. The British soldiers captured and imprisoned eight of the settlers, but their release was gained by capturing enough British soldiers to effect an exchange. After other such incidents, three hundred settlers laid siege to the fort, eventually forcing withdrawal of the garrison.

The region west of the Alleghenies in southwestern Pennsylvania did have a few English settlers, but most came not from the eastern section of William Penn's province but from Virginia and Maryland. The tide of settlement which had moved steadily westward to the Alleghenies was arrested by the mountain barrier and deflected northward through the Cumberland Valley. A few pioneers from Virginia and Maryland entered the trans-Allegheny region as early as 1753 by way of Braddock's Road, which was an Indian trail from Cumberland, Maryland to Pittsburgh. However, in 1768, by a treaty with the Iroquois at Fort Stanwix, a vast region was acquired extending diagonally across the province from the extreme northeast to the extreme southwest. This area, commonly called the "New Purchase," was the last which the proprietary government acquired from the Indians. With this purchase, more settlers moved westward.

During this same period, settlement occurred in the northeastern portion of the state. A few pioneers had come to this region from New England in the late 1700's. But in 1753, an association known as the Susquehanna Company was formed in Connecticut for the intensive settlement of the Wyoming territory. Over six hundred Connecticut people and fifty others from Rhode Island, Massachusetts, New York, and Pennsylvania, invested in the stock of the syndicate, though it was essentially a Connecticut enterprise. Connecticut's claim to the territory was based on the Royal Charter of 1662, which defined the colony's western boundary as extending to the Pacific Ocean but excepting any territory "than possessed by other Christian prince or state."1/ New York was inhabited and, thus, its boundary was not in dispute.

In 1782, after many years of bickering and a few skirmishes, Congress settled the boundary dispute in favor of Pennsylvania. The result of the

---

1/ William Cornell and Millard Altland, Pennsylvania Milestones (State College, Pa., 1957). p. 154.

whole controversy was the introduction into Pennsylvania of a large number of New Englanders, who settled on both sides of the Susquehanna from Wilkes-Barre to the New York line.

The earliest European settlers in the western portion of the state were French. They recognized the strategic importance of a triangular land area formed by the confluence of the Allegheny and Monongahela Rivers at the headwaters of the Ohio River. The French built a military outpost, Fort Duquesne, at the Forks so that they could control access to the Ohio Valley. The Ohio River (and its tributaries) was the highway to the south and to the west. The French were established in Canada and at the mouth of the Mississippi; if they could control the interior they could keep the English behind the Appalachian mountain barrier and win dominion over the Great Valley. The struggle between the French and English ensued for nine years until 1758 when the French were driven out of Fort Duquesne. The English had won control of the interior and Fort Pitt (formerly Duquesne) was to become the easternmost outpost of the vast hinterland that stretched out to the Mississippi.

Although a few settlers had crossed the Alleghenies as early as 1750, it was not until these lands were formally opened for settlement by the land purchase of 1768 that important immigration into trans-Allegheny Pennsylvania began. For some years the conflicting claims which Virginia and Pennsylvania held to this region produced much confusion in land titles. Consequently, there was restricted settlement under Pennsylvania title and most of the pioneers in the section were from Virginia.

During the Revolution, the westward immigration slackened, but it increased after the war when migration came again from eastern Pennsylvania.

This was stimulated by a treaty with the Indians at Fort Stanwix in 1784, which secured the remaining area of the commonwealth, embracing the north central and the northwestern portions of the state.

After the adoption of the federal constitution and the passage of the ordinance for government of the Northwest Territory in 1787, the tide of immigration into the west swelled. As the newcomers moved to their future homes in the Ohio Valley, in Kentucky, or in Indiana, they halted at the Forks, where they built or bought their boats and acquired supplies and foods. Pittsburgh became the "Gateway to the West."

Pittsburgh was then a struggling village with a population of 1,200 and about to enter upon a career of rapid progress. Pittsburgh grew because of its geographical location. The mountains in the east made transportation from the seaboard hazardous and expensive. Thus, the people of the town had to rely on themselves to produce the things they needed. The two great rivers - vital arteries of communication and trade - that flowed together at Pittsburgh boosted its development. The Allegheny, coming from the north, connected northern Pennsylvania with the southern part of the state, while the Monongahela, flowing from the south, tapped the commerce of northern Virginia and the eastern corner of western Pennsylvania. It was in Pittsburgh that overland and river traffic met. Here the goods, brought over the mountains on the backs of packhorses or in Conestoga wagons, were put in the river boats which transported them and the region's goods down the Ohio and the Mississippi.

The last area of land that was to be acquired by Pennsylvania was the Erie triangle. Connecticut, New York, and Massachusetts had claims to this area, but Congress took up Pennsylvania's plea for adequate frontage on Lake Erie and requested Connecticut, New York, and Massachusetts to relinquish their claims to the territory. It was, therefore, deeded to the U.S. Government, and in 1792, was sold to Pennsylvania for $151,540.

Communication and transportation between settlements were difficult, and early inhabitants had to rely on the river and Indian trails. Roads to the interior were being constructed, but they were rough and difficult to travel. The rivers were used as highways for rafts and dugouts to transport farm goods to a central market. The products of southern, southeastern and central Pennsylvania found a market chiefly in Philadelphia, whence the surplus was either distributed to Atlantic ports or shipped abroad.

Manufacturing began in the weaving shops in Philadelphia following the Revolution. Water powered the mills and cheap labor was readily available in the city. During this period, water power stimulated industrial growth. In addition, iron production was expanded to meet the needs of a growing post-revolution population. Water power, however, soon gave way to steam power and more and more factories sprang up in and around Philadelphia.

The city and its region became a major manufacturing, trade, and population center, but transportation was a problem. This was later resolved by the construction of a number of canals during the 1830's. The major canal in this region went from Philadelphia to Pottsville - but the overall goal was "navigable communications between the eastern and western waters of the state and Lake Erie."[1/] Canal building was stimulated by competition for western trade. It was recognized on all

---

[1/] Wayland F. Dunway, History of Pennsylvania, 3rd ed., (Englewood Cliffs, N.J.), p. 594.

sides that the trade of the developing West was a prize well worth competing for and that it would be captured by the Atlantic port which offered the quickest and cheapest transportation to the seaboard. Philadelphia was threatened with the loss of this trade to New York, since the Erie Canal gave that city an all-water connection with the West. Furthermore, Baltimore was fast becoming a serious commerical rival of Philadelphia, not only because the natural outlet of the Susquehanna Valley region was down the river to Baltimore, but also because the latter city was 90 miles nearer to Pittsburgh than Philadelphia and thus had cheaper freight rates to and from the West.

In colonial times and up to 1800, Philadelphia was the capital of the nation, the capital of the state, and the economic leader in the colonies. By 1825, all this had changed. The nation's capital was moved to Washington, D.C., the state capital was moved first to Lancaster, then to Harrisburg, and New York City was on its way to becoming the economic center of the nation. Although Philadelphia had descended from its colonial pinnacle, the city of Pittsburgh was beginning its ascent as a western industrial center.

At the beginning of the 19th century the iron industry started to develop. Although iron was manufactured west of the Alleghenies in Fayette County as early as 1790, this was not done on a large scale. Most iron products were imported from England, but the War of 1812 isolated the United States and stimulated manufacturing. Until 1840, most American iron was smelted with charcoal rather than with coke. Since both timber and iron deposits were widely scattered throughout the county, the geography of the iron industry was determined by access to markets and the availability of labor, not by the location of raw materials. Philadelphia had been the marketing center.

The technology of iron-making did not change much before 1840 other than that furnaces, forges and rolling mills grew steadily larger. However, the revolution in machinery and the coming of the railroad made new demands upon the iron industry. This pressure began to motivate technological advances in the industry. Increased production was impossible so long as it depended upon charcoal to fire the furnaces. The forests to make charcoal were fast disappearing in the iron-making regions. The pressure for another practical iron furnace fuel turned attention to coal.

Pennsylvania coal was first discovered in 1762, and by 1803, two arkloads of Lehigh anthracite were shipped down the Lehigh and Delaware Rivers to Philadelphia. But coal was not mined industrially until anthracite was used successfully in 1836, to fire an iron furnace. Anthracite had become popular as a home fuel because it burned cleanly whereas bituminous coal was much more sooty. The combined industrial and home use of anthracite increased its market, and the eastern portion of the state, where most of the anthracite was located, thrived. Vast quantities of bituminous coal were located in the western portion of the state, and ironmongers there were challenged to find a new fuel using bituminous coal. They solved the problem by using a beehive oven in which soft coal was burned for several days - coke was the result.

Coke was the new fuel that could resist blast furnace pressure and brought on new techniques for smelting iron, which improved the product. With this discovery, the manufacture of iron gravitated to the western coal producing region, where bituminous coal was localized in a few great deposits around Pittsburgh. At this point, the raw fuel location, rather than the market centers, determined the location of the iron industry.

The combination of rich natural resources and a vast system of waterways enabled Pittsburgh to become an industrial center. Natural resources from northern and central Pennsylvania such as lumber, oil, iron, and coal, although bulk commodities, could be transported easily by water into Pittsburgh. Here, mills and factories powered by water and steam produced finished goods that were shipped easily to outside markets. The Appalachian mountain barrier to the east determined that these primary markets would be to the north, west, and south of Pittsburgh. Thus, the Ohio River became the main artery leading to these markets.

The transportation barriers that blocked the development of eastern trade helped the growth of industry. The high cost of moving manufactured goods over the mountains from the east offered some local merchants the opportunity to produce them on the spot and thus to profit from the economy of location.

After the Civil War, industrial progress throughout the state was characterized by the full development of the factory system, enlarged capital resources, increased use of migrant labor, international markets, and the concentration and specialization of industry. Household industry and the shop gave way gradually to the factory. The growth of iron and steel manufacture continued with the Pittsburgh industrial area the great center of this industry. Iron works produced stoves, pipes, hardware, cannons, steamboats, railways, and steamships. Iron rolling was stimulated by the growth of railroads, bridge building, and beams for buildings. Pittsburgh became a center of western manufacturing.

The only resource that these industries lacked was labor, but a steady flow of immigration was to remedy that. Between 1840 and 1890, population in this area increased rapidly due primarily to immigration. There were 731,505 foreign-born persons in the state by 1890.1/

Development of the coal mines in the state attracted thousands of immigrants. Until 1870, all immigration was from northern Europe and the British Isles, with the Irish predominating. Then, mine operators sent representatives to central and southern Europe to induce peasants to come to the coal fields. They came and population increased rapidly. The statewide population increased from approximately 1,700,000 in 1840 to 5,250,000 in 1890.

The industrial peak was reached between 1870 and 1900. In 1870, the Pittsburgh region was producing one-fifth of the nation's coal, one-third of which was converted to coke and used in Pittsburgh's steel mills. By 1900, the Pittsburgh district supplied one-half of the nation's open hearth steel.

1/ Ibid, p. 528.

Pennsylvania entered the twentieth century as a major industrial state. It was the nation's largest producer of steel, coke, and tin. More coal was mined here than in any other state. Pennsylvania also became a leader in the production of oil. New industrial development in transportation and manufacturing that occurred outside Pennsylvania, undermined the state's industrial supremacy. Although the steel used in the building of automobiles and airplanes came from Pennsylvania, their manufacture was located outside the state. Also, the advent of the car, motor truck and plane marked the decline of the railroad. By 1915, the railroads had ceased to grow - for they failed to develop a modern approach to freight and passenger service. After World War I, a gradual abandonment of short lines and the elimination of many passenger trains reduced both passenger and freight service in Pennsylvania.

Also, after World War I, the coal industry was adversely affected by new technology and automation. New sources of power, especially electricity, contributed to the declining use of coal. Oil and natural gas supplanted coal as the home heating fuel primarily because they were more convenient to store and use. As a result of this decline and changing technology, unemployment in the coal industry mushroomed. "In 1941, coal production (in the Pittsburgh region) amounted to 90 million tons, with a total employment of nearly 83,000 miners. By 1964, production had decreased 46% to 48 million tons, but employment fell nearly twice as fast (by 80%) to 16,000 jobs."[1/] This loss of employment resulted in an economic depression in the eastern anthracite

---

[1/] Regional Development Reconnaissance, Pa. State Planning Board, Jan. 1966, p. 4.

region, as well as in the outlying areas near Pittsburgh where coal mining was the principal source of employment.

Industrial and community redevelopment is being undertaken in these distressed areas, and efforts to develop programs for retraining workers from the mines is also underway.

Several factors contributed to the state's industrial development including Pennsylvania's location to domestic markets and to foreign trade. Coal and iron are the twin pillars of industry and the state possessed both minerals in vast quantities. But, Pennsylvania's fame as a manufacturing and mining community has tended to overshadow its importance as an agricultural state.

Pennsylvania is well suited for agriculture, since the state has large areas of fertile soil adapted to a wide range of crops. The Piedmont region and the limestone valleys are especially fertile. Furthermore, the climate and rainfall are conducive to productive agriculture, while the marketing facilities are excellent.

The regional characteristics of the state farming areas are briefly noted. Southeastern Pennsylvania, with its residual soils and rolling land, is the most important farming region in the state. It is a general farming district with mushroom production ranking first in the nation, tobacco ranking ninth, cut flowers fourth, corn silage seventh, and calves and hog slaughter ranking fourth and sixth respectively.1/ Dairy farming is also important in the northern

---

1/ Pennsylvania Department of Agriculture Crop Reporting Service, 1973 Crop and Livestock Annual Summary, p. 70-71.

portion of this area where the glaciated soil and short growing season lend themselves to production of hay and the raising of dairy cows. The productivity of this area is significant as the state ranks fifth in the nation in milk production and number of milk cows. Most of the dairy products from this area are marketed in the Philadelphia and New York metropolitan regions. The southeastern Pennsylvania region is also a poultry center. Pennsylvania ranks sixth and fourth in the nation for numbers of chickens (excluding broilers) and layers respectively. And the state also ranks fourth in egg production and sixth in egg-type chick hatching.

The Appalachian district, which has mountains with intervening valleys of residual soils, is the next most fertile area, producing cereals, potatoes, apples, and livestock. Again, the state is fifth among all other states in the production of timothy seed and apples.

The Lake Erie region is a fruit growing region, which places Pennsylvania fifth in peach and pear, fourth in grapes, ninth in sweet cherries, and fourth in the production of tart cherries on a national scale.

These statistics amply sustain the claim that Pennsylvania is one of the leading agricultural entities in the United States.

CHAPTER III. GENERAL PROJECTION METHODOLOGY - AGRICULTURAL PRODUCTION

The location of agricultural production is influenced by a variety of factors, each of which must be taken into account in projecting future activity. On the demand side, new national markets have become increasingly important with technological advances in food processing. Transportation, population, and income estimates are also included in the demand estimation procedures. On the supply side, production capacity changes with both availability of resources and the rate of technology adoption.

Basic Assumptions

This study utilized state level projections of economic activity for Pennsylvania which were the outgrowth of a nationally consistent set of projections for water resource planning. These projections are derived from a program of economic measurement, analysis, and projections conducted by the Bureau of Economic Analysis of the U.S. Department of Commerce and the Economic Research Service (OBERS) primarily for the Water Resources Council. They are an integral part of the comprehensive water resources planning program and national assessments of water and related land resources.

There are two levels of assumptions in the OBERS projections that relate to this study: those of a general nature underlying all OBERS economic projections, and those specific to the projection of agricultural production. The general assumptions are those pertaining to economic activity and include the following:

a. Growth of production will be conditioned by a decline in fertility rates from those of the 1962-1965 periods.

b. Nationally, reasonably full employment, represented by a 4 percent unemployment rate, will prevail at the points for which projections are made. Unemployment will be disproportionately distributed regionally, but the extent of this will diminish with time.

c. No foreign conflicts are assumed to occur at the projection dates.

d. Continued technological progress and capital accumulation will support a growth in private output per manhour of 3 percent annually.

e. Growth in output can be achieved without ecological disasters or serious deterioration, although diversion of resources for pollution control will cause changes in the industrial mix of output.

The following were assumed for the OBERS state economic projections:

a. Most factors that have influenced historical shifts in regional "export" industry location will continue into the future with varying degrees of intensity.

b. Trends toward economic area self-sufficiency in local-service industries will continue.

c. Workers will migrate to areas of economic opportunities and away from slow growth or declining areas.

d. Regional earnings per worker and income per capita will continue to converge toward the national average.

e. Regional employment/population ratios will tend to move toward the national ratio.

In addition to these underlying assumptions, there is a set of assumptions specific to agricultural projections:

a. Based on the Series C projections of population and per capita income, per capita annual consumption of agricultural products are estimated as follows:

	1963-65 Av.	1968-70 Av.	1980	2000	2020
	---------------	---------pounds	-----------	-----------	-------
Beef and veal	103	115	130	135	140
Poultry	39	47	59	63	65
Dairy products	627	570	475	450	425
Citrus fruit	66	88	110	118	120
Non-citrus fruit	102	101	99	92	86
Potatoes	110	117	110	110	110
Wheat	158	153	150	140	134
Total	1,205	1,191	1,133	1,109	1,080

Source: OBERS projections, Vol. 1 (1972).

These figures take into account a rising trend of prices of livestock products relative to those of field crops, but the demands for agricultural production were projected under the assumption that the price of agricultural products relative to all other consumer products "will not be materially altered."

b. There were assumed to be no shortages.

c. In addition to food demands for agricultural products, several nonfood uses of crops were incorporated into the OBERS projections.

1. Livestock and poultry populations were assumed to exert a significant demand on feed grains, protein feeds, and roughage, depending upon feed utilization per unit of livestock output. Feed utilization in 1980 was assumed to be consistent with current practices and performances. From 1980 to 2020, however, feed utilization per unit of output was assumed to decline by ten percent, as more efficient use of feed concentrates, expanded use of substitutes for concentrated food sources, and improvements in management and breeding take effect.

2. The other domestic nonfood uses of crops are in manufacturing and seed production. The rate of change between a 1959-61 average and the 1980 level was utilized in making the 2000 and 2020 projections of these nonfood uses of feed grains. Nonfood uses of vegetables, potatoes, and noncitrus fruit were projected to change at the same rate as their respective food uses; and projected changes for other agricultural products were based on extensions of historical data.

d. A final component of the projected agricultural demands is net exports. Underlying the OBERS Series C projections in this area was the assumption that beyond 1980 U.S. exports will, despite their continued increase, represent a smaller share of total U.S. production. No attempt was made to predict changes in national trade and food aid policies. The export projections are considered an interpretation of the policies as they existed when the projections were made.

Methodology

Based on the usually high correlation of production values across time, most econometric forecasting models include as an independent variable the production values from previous time periods. Because of fixed investments, economic activity will rarely show a radical change from one period to the next, and many of the factors which lead to comparative advantage for an area at one time period are likely to be present in another. In agriculture this is especially true where the physical characteristics of production such as soils, climate, and topography are relatively permanent. At the core of the method of projection used in this report is the relation of a subregion's production in one time period to its production in past periods; and the additional response of the subregion's agricultural production to change in projected demands. Both of these elements are present in a form of regional analysis called "shift-share" analysis. A modified form of shift-share analysis was employed in this study.

Shift-Share Analysis

In shift-share analysis it is assumed that the change in a subregion's production from one time period to the next will vary directly with the projected change in the state's production during that period. (This assumption is particularly pertinent in the projection of agricultural production, where the state's market is of great importance in the determination of subregion production levels). If state demands are projected, the production necessary to meet these demands may be determined. The change in production at the state level, in turn, is assumed to be distributed among subregions so that each reflects the change in state production over the previous period.

In addition to the state shift is a "distributional shift," or the shift in production whereby a subregion's share of the state's production changes relative to that of other subregions. Again, this assumption is pertinent to agriculture in that many of the factors which give one subregion a comparative advantage over others - soil conditions, climate, and topography - may be expected to continue from one period to the next, and are reflected in a shift in production toward that subregion.

The change in a subregion's production is thus accounted for by state changes in production and shifts in the distribution of state production among the subregions. Each of these effects is taken into account when, by the method described in this report, a subregion's share of state production is projected and applied to target date estimates of state totals. State-level production changes are allocated among the subregions in proportion to their projected shares. Subregion share changes, in turn, take into account the distributional shifts in production among the subregions.

This procedure, hereafter referred to as a "shares analysis," may be clarified by a brief graphical treatment. First a situation is examined in which only the change in production at the state level bears upon the subregion's production. Where R_T, R_F, S_T, and S_F represent production in the subregion and state, respectively, at times T (present) and F (future),

$$R_F = \left(\frac{S_F}{S_T}\right) \cdot R_T$$

$\left(\frac{S_F}{S_T}\right)$, the state's rate of production growth, is applied to production in a subregion at the base time T. This implies that

$$R_F = \left(\frac{R_T}{S_T}\right) \cdot S_F$$

or that the subregion's share of state production remains constant from time T to time F, as seen in Figure 3.

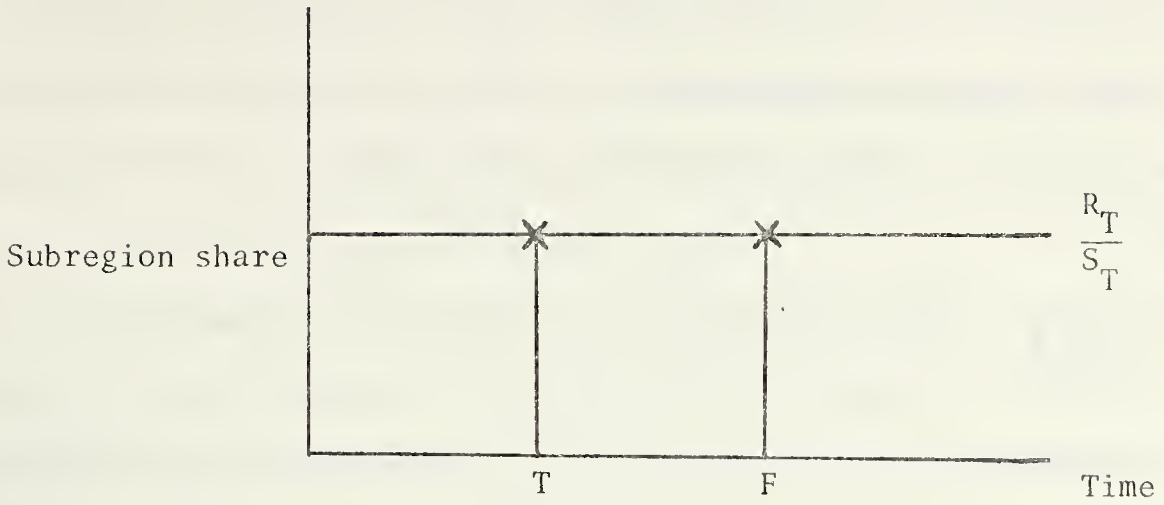


Figure 3. Example of constant share

Now a distributional effect - the shift in production toward one subregion over others - is introduced. Let R_Δ represent the quantity a subregion produces over or under the production attributed to the state effect.

$$R_F = \left(\frac{S_F}{S_T}\right) . R_T + R_\Delta$$

$$R_F = \left(\frac{R_T}{S_T}\right) . S_F + \left(\frac{R_\Delta}{S_F}\right) . S_F$$

which may be put in terms of state production in the future at F as

$$R_F = \left[\left(\frac{R_T}{S_T}\right) + \left(\frac{R_\Delta}{S_F}\right)\right] . S_F$$

This equation, which expresses subregional production as a share of the projected state production, is fundamental to the method of projection described in this report.

All subregion production estimates for the target period were derived by projecting the subregion's share - the term in brackets - and applying it to the published OBERS state totals. Its share at time T,

$\left(\frac{R_T}{S_T}\right)$, when multiplied by S_F, yields the regional production at F accounted for by the state effect. The change in the region's share

$\left(\frac{R_\Delta}{S_F}\right)$, when similarly multiplied, indicates the distributional effect (see Figure 4).

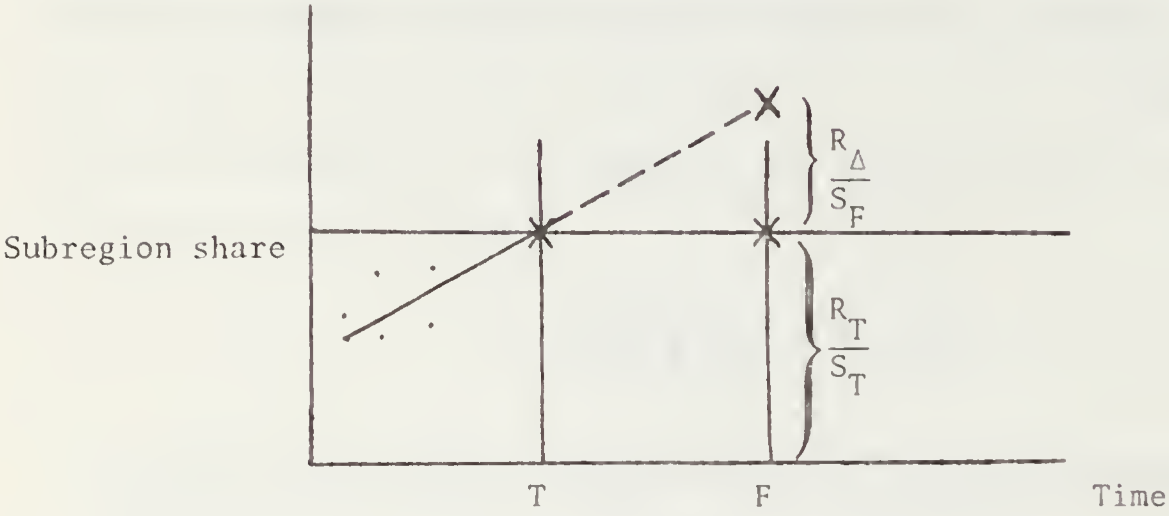


Figure 4. Example of changing share

A curvilinear projection of the subregion shares was found to be appropriate in the projection of agricultural activity. If a subregion's share increased rapidly in the historical period, it was assumed that such increases would not be sustained through the target dates, and they would gradually be suppressed. Similarly, if a subregion's historical shares of state production showed rapid decreases in the historical period, it was assumed the decreases would not be sustained through the target dates.

A projection function which is well suited to these characteristics of agricultural production is the "Spillman" function. For rising subregion shares, the Spillman sets limits by means of a linear regression; and it estimates target date shares to approach these limits (asymptotically) in a curvilinear fashion, thus registering less rapid increases with time. For a falling trend, the shares are assumed always to remain positive; and zero was set as a lower limit, with the shares approaching it again in a curvilinear fashion to register less rapid decreases with time.

Spillman Projection Function

The Spillman is an exponential function which essentially extends a trend line within predetermined limits so that it approaches those limits in a curvilinear fashion.1/ Values to be projected are first paired with their historical dates, with the latter given here in number of years from a base date (1954). To aid in setting the limits a best fitting trend through this historical data is first estimated by linear regression, and the historical values are projected to target years. The initial regression determines whether the historical trend rises or falls and the rate of its change.

1/ OBERS Projections: Vol. 1: Concepts, Methodology and Summary Data, Washington: U.S. Water Resources Council, 1972.

There are drawbacks to the use of the linear regression, however. If the trend rises, the results might ignore fundamental constraints on values such as the percentage of a state's total area represented by a subregion. If the trend falls, on the other hand, extrapolated values of less than zero are frequently the result for the target dates -- a result which would be without meaning in the projection of agricultural production. These drawbacks are mitigated by the procedure of setting (reasonable) bounds to the projections, a procedure in which the preliminary linear extrapolations prove quite useful.

This technique is particularly well suited to agricultural projections. Diminishing returns characterize much agricultural activity; so, for a rising trend the linear trend often lies above the most recent historical values. The linear extrapolations, therefore, provide appropriate upper limits to the projections. The corresponding limit for a falling trend is zero or some realistic minimum level consistent with the characteristic being projected (such as family size or cropland acreage).

Consistent with the OBERS methodology, this study assigned the value of the linear trend for 1990 as the ceiling for a subregion's percentage of state land in farms and production. Higher ceilings were set for measures such as yield and average farm size which were constrained by factors other than the subregion's relative size. Again to be consistent with the OBERS methodology, the extrapolation date on the linear trend for these values was set at 2020. An exception to the zero base value was established for numbers of inhabitants per average farm family; an average which consistently fell during the historical period for each of the subregions. Although the decline was quite sharp in some subregions, it was felt that this average would not realistically drop below 2.5 persons per farm in view of farm labor needs. The limits set in this manner were adjusted where the resulting projections seemed unreasonable.

Once the limits are set, a trend line is constructed which approaches the upper or lower bound in a curvilinear fashion. This is accomplished by transforming into logarithms the differences between historical figures and the limits. A "loglinear" regression extends these transformations to the target dates, where they are converted back to linear distance by taking their antilogarithms. Subtracting the antilogarithms from the ceiling or adding them to the base provides a trend with the desired properties.

This procedure is seen more easily in diagrammatic form. A case which exhibits increasing historical values is illustrated. First, limits are set through the use of preliminary linear regression, extended to the target dates as described below (Figure 5).

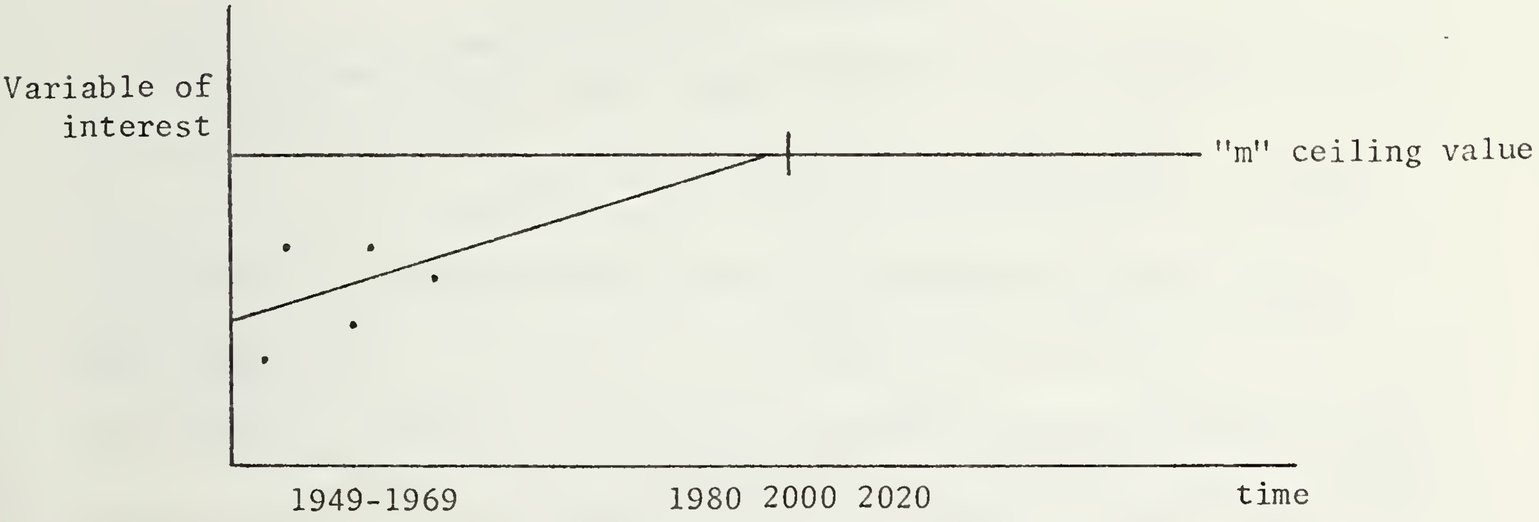


Figure 5. Ceiling value set

Logarithms are then taken of the difference between historical values and the ceiling or base (Figure 6).

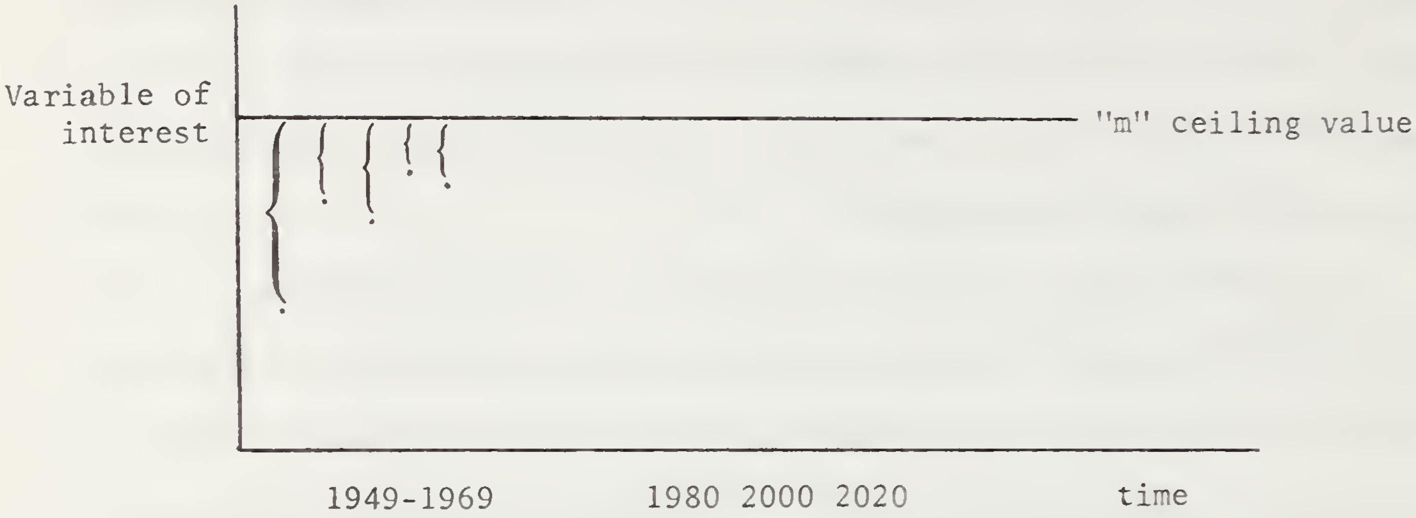


Figure 6. Logarithms of difference computed

Third, the best fitting line through the logarithms of the differences is computed and extrapolated to the target dates (Figure 7).

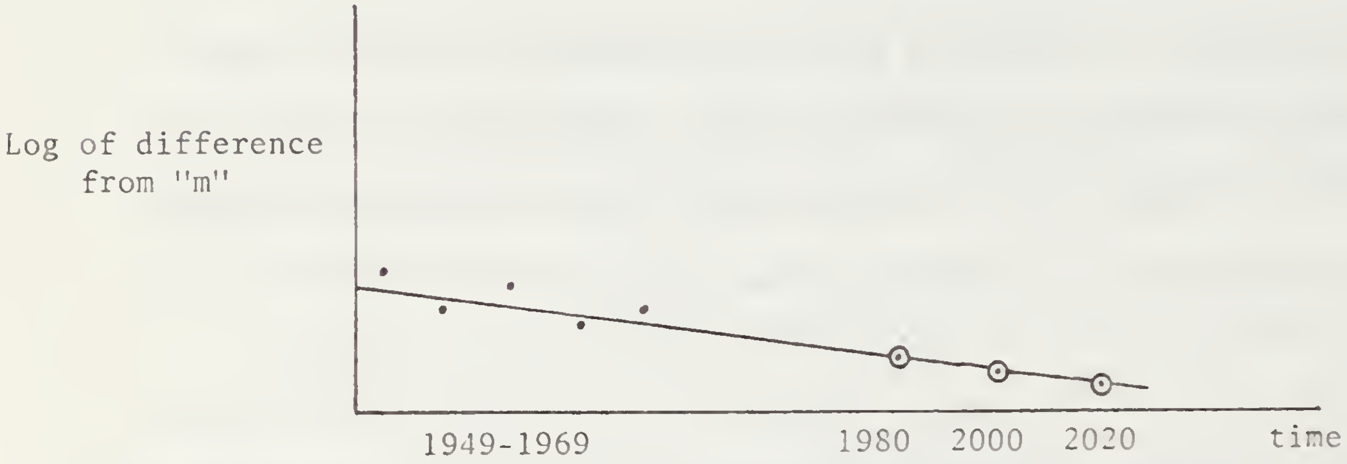


Figure 7. Logarithms of differences projected.

Finally, the extrapolated values are transformed back to linear distance by taking their antilogarithms. Subtracting the antilogarithms from the ceiling figure or adding it to the base provides the projection values of interest for the target dates (Figure 8).

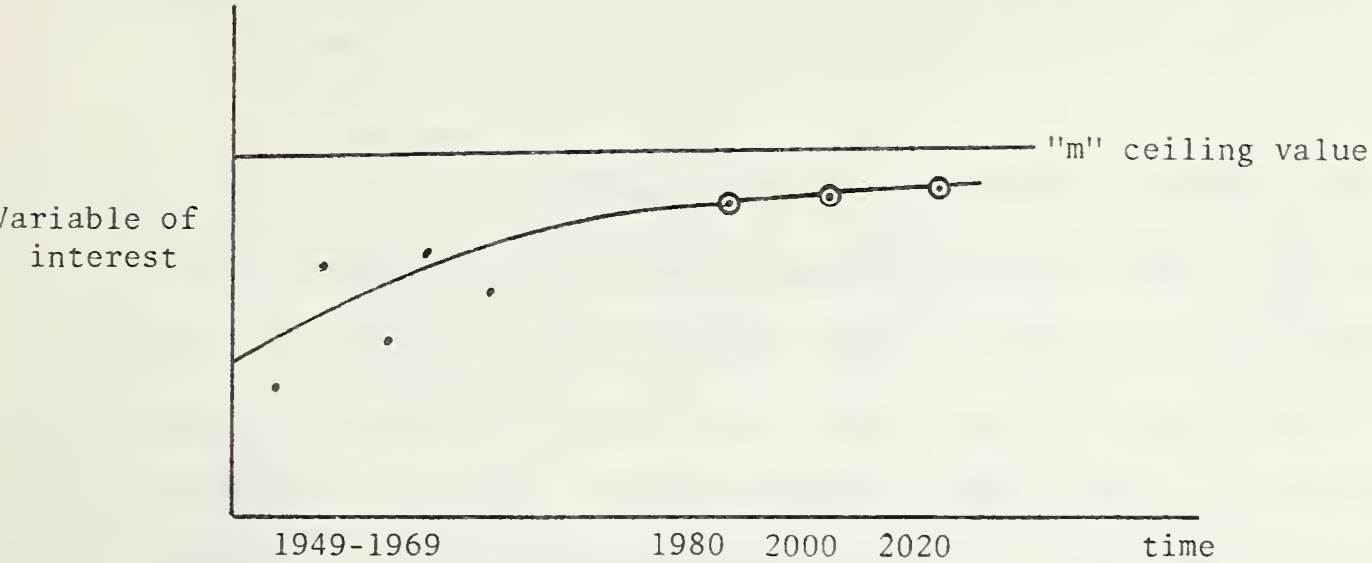


Figure 8. Antilogarithms taken and projection values obtained.

The general form of the equation used is

$Y = M \pm ab^{X}$ Where M represents the base or ceiling value

In regression format,

$$\log \left| Y - M \right| = A' + B'X$$

where $A' = \log a$

$B' = \log b$

and the quantity to be operated upon on the left side represents the loglinear distance to the base or ceiling value.

Agricultural Production

This section documents the projection of crop and livestock production levels by subregion. These were necessary first steps in preparation for projecting farm population and labor force distributions, evaluating agricultural water use, and estimating future land use changes.

Crop Production

Projections of major crop production were developed using historical data from the Agricultural Census at both the state and county level and

OBERS projections of state crop production in the target years. County data were aggregated into subregions after the projections were complete.

Crop production in each subregion was projected by a shares analysis to take into account both distributional shifts among the subregions and the OBERS-projected changes in state-level demands for each crop. Yields were then projected. It was assumed, as in the OBERS projections, that during the period 1970 - 2020, the past trend of increase in agricultural research and development since the Second World War would continue but at a slower rate. Although more extensive use of fertilizers and pesticides and improved crop varieties and management practices are expected in the target period, the recent record of dramatic technological breakthroughs is expected to be difficult to sustain. In addition, a lag is expected in the implementation of new technologies. Both of these factors will tend to diminish the rate of yield growth.

Yields were projected by the function employed in the projection of subregion production shares, with a slight alteration to allow them to vary with time more than the subregion shares of state production. It was possible to estimate acreage for each crop from the estimates of future crop production and expected yield (production per acre).

The procedure is easily broken into its component parts (Figure 9). First, future state crop production was disaggregated into subregion production according to the estimated shares accounted for by each of the county components of subregions. Data used were historical state and subregion crop production figures (directly from or aggregated from the agricultural censuses) and projected state production estimates from

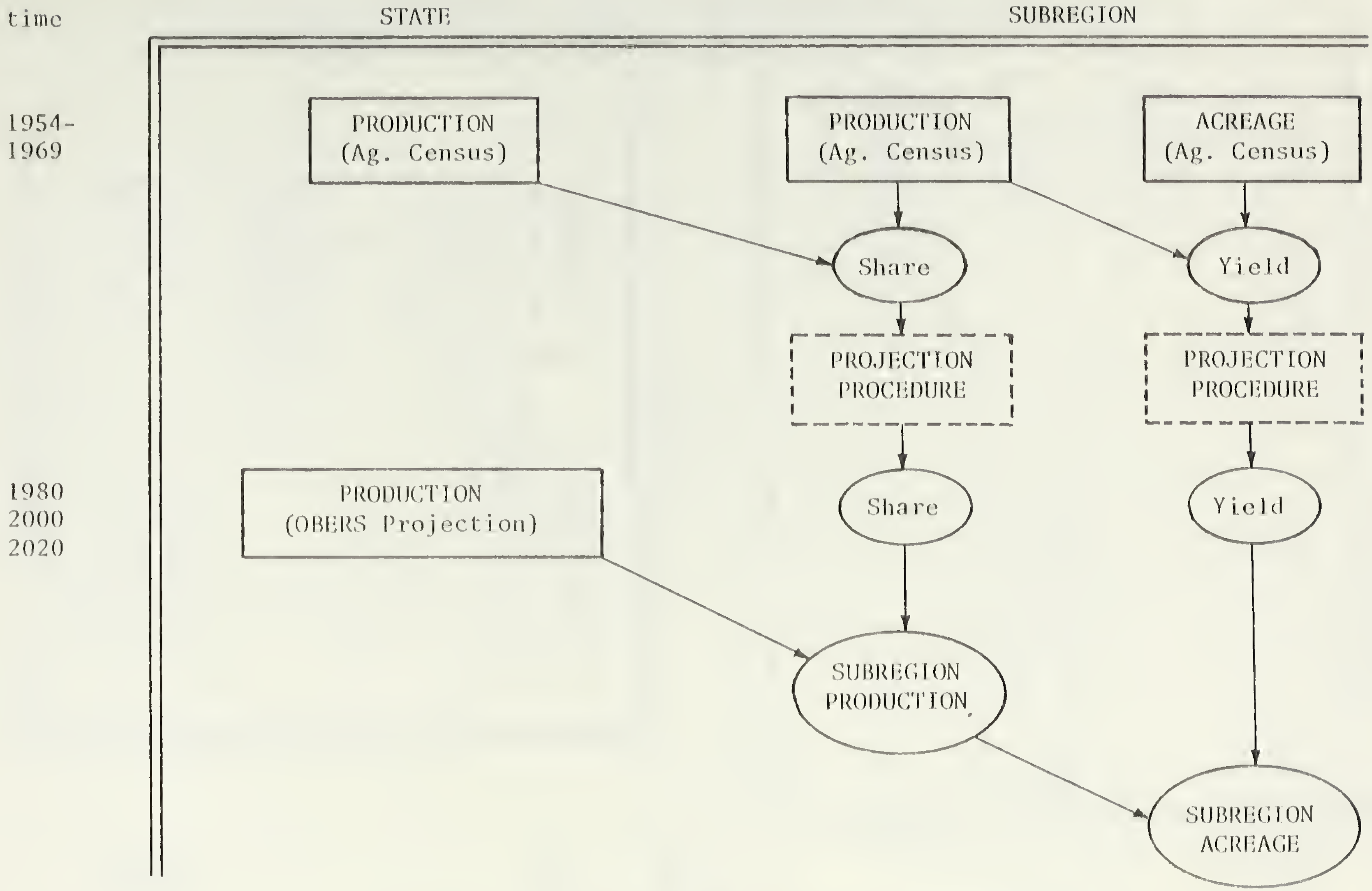


Figure 9. Projection of production and acreage by crop

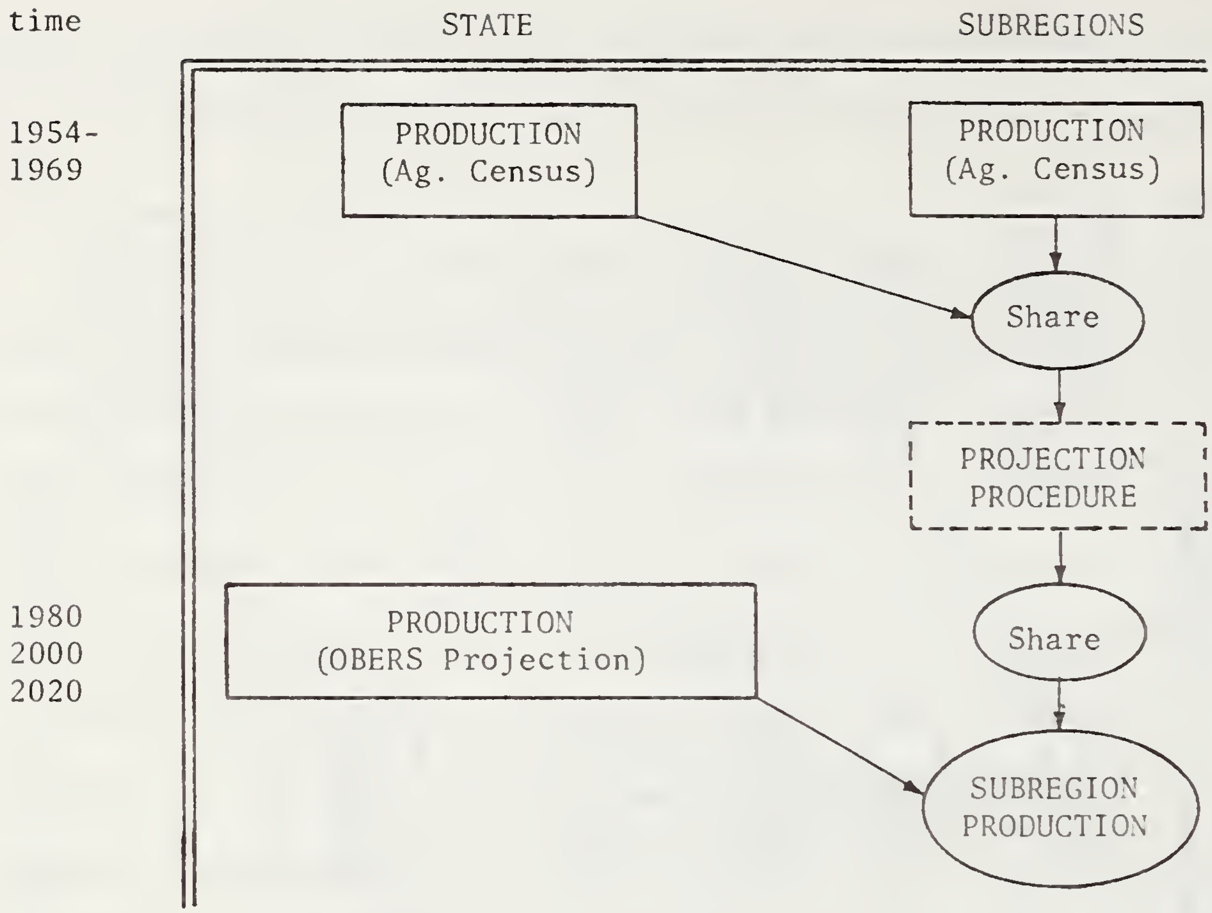


Figure 10. Projection of subregion production

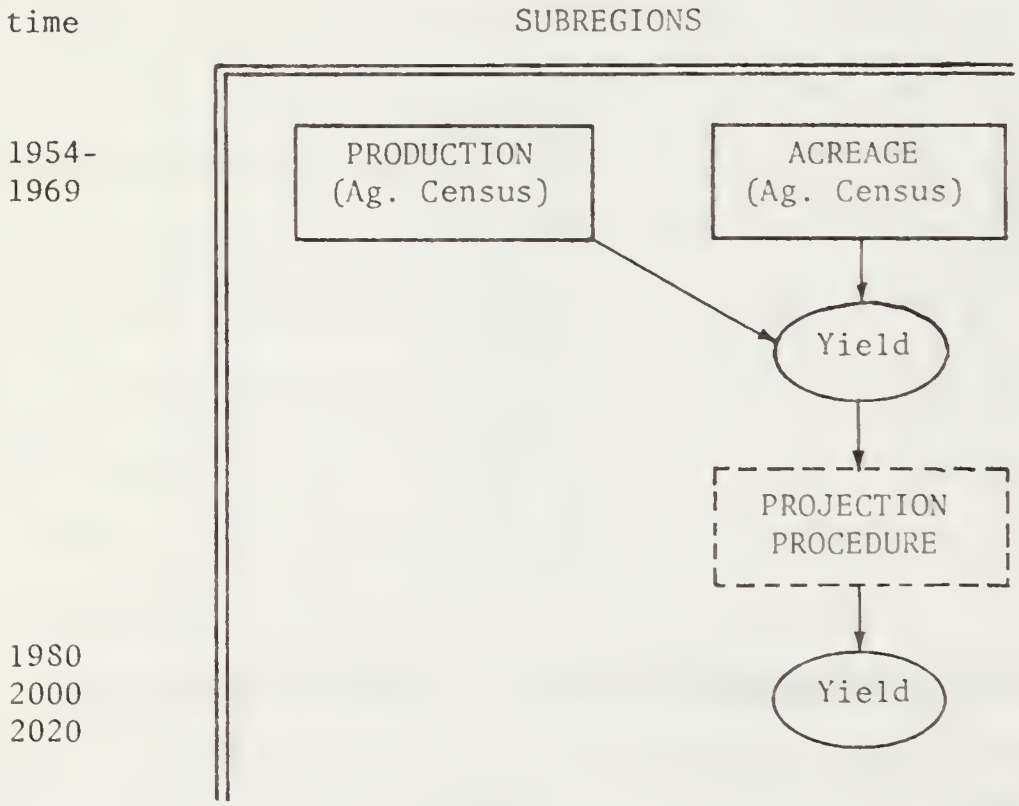


Figure 11. Projection of subregion yield

OBERS. Historical shares were calculated by dividing county production figures into state totals for each of the census years. A Spillman extrapolation (labeled PROJECTION PROCEDURE in Figure 9) was then performed on the trend of historical shares to estimate future shares accounted for by each subregion. The estimated future shares, applied to the OBERS projections of state totals, gave future subregion production estimates for the target dates (Figure 10).

The next step in the procedure was the projection of crop yields (Figure 11). Data used were historical production and acreage figures, for each crop, from the Censuses of Agriculture. To calculate historical yields in each subregion, historical crop production was divided by acreage. The Spillman projection procedure was then used to obtain estimated target data yields from past yield trends.

Following these two steps, the estimated acreage requirements in each subregion were easily calculated by dividing its projected crop production by the yield (production per acre) expected in that subregion (Figure 12).

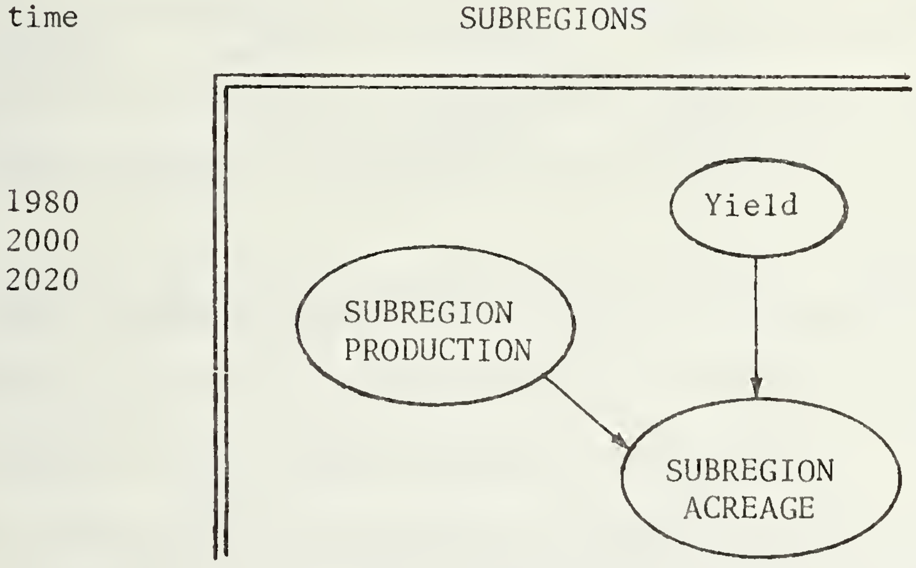


Figure 12. Derivation of subregion acreage

Tabular data reflecting historical and projected crop production and acreage by each of the twenty state subregions are presented in Appendix B for those interested in relative production levels. These data are distributed among the subregions for state level OBERS Series C and E projections. Values for wheat, corn silage, corn grain, hay, tobacco, potatoes, vegetables, and orchard crops are provided.

Livestock Production

As in the estimation of crop production, livestock numbers were projected by first estimating production at the county level and aggregating to the subregions. This was accomplished using a shares analysis. Data used in this part of the study were Agricultural Census data for livestock numbers at the state and county levels, and OBERS projections of state demands for livestock and livestock products in the target years. County data were aggregated into subregion groups following projection.

In this procedure the shares analysis was modified somewhat to take into account the form of the OBERS state livestock projections, which were in terms of live weight demanded at the market in the target date years. Once state level estimates of live weight at market were allocated among the subregions, it was necessary to convert market weight into livestock numbers.

State level demands for livestock and livestock products were converted to livestock numbers by dividing them by a set of average livestock weights or - in the case of chickens and milk cows - productivity. The set of average livestock weights developed for the conversion of production to livestock numbers is given in Table 1. While the weights roughly parallelled the 1970 market weights for the study, they nonetheless reflected changes in livestock production now underway. The conversion weights for pork and sheep were slightly higher than current levels, taking into account the development of more efficient feeding practices and improved breeds. Similarly, milk and egg production was assumed to increase over current levels due to improvements in nutrition and management practices permitting better performance tests and selective breeding. The average weight assumed for turkeys, however, was assumed to be slightly below current levels, due to market preferences for slightly smaller birds.

Table 1--Average market weights, livestock and livestock products, target projection years

	Unit	1980	2000	2020
Hogs - pigs	lb	230	230	230
Sheep - lambs	lb	110	110	110
Broilers	lb	3.5	3.5	3.5
Turkeys	lb	15	15	15
Eggs/chickens	eggs	240	265	280
Milk/cows	lb	10818	12097	12218

Figure 13 shows the procedure used to project livestock numbers in a subregion. First, historical shares of state-level livestock production were calculated, from census data, for each subregion. The shares are projected using the Spillman function (labelled PROJECTION PROCEDURE). OBERS estimates of state-level demands for livestock products are then

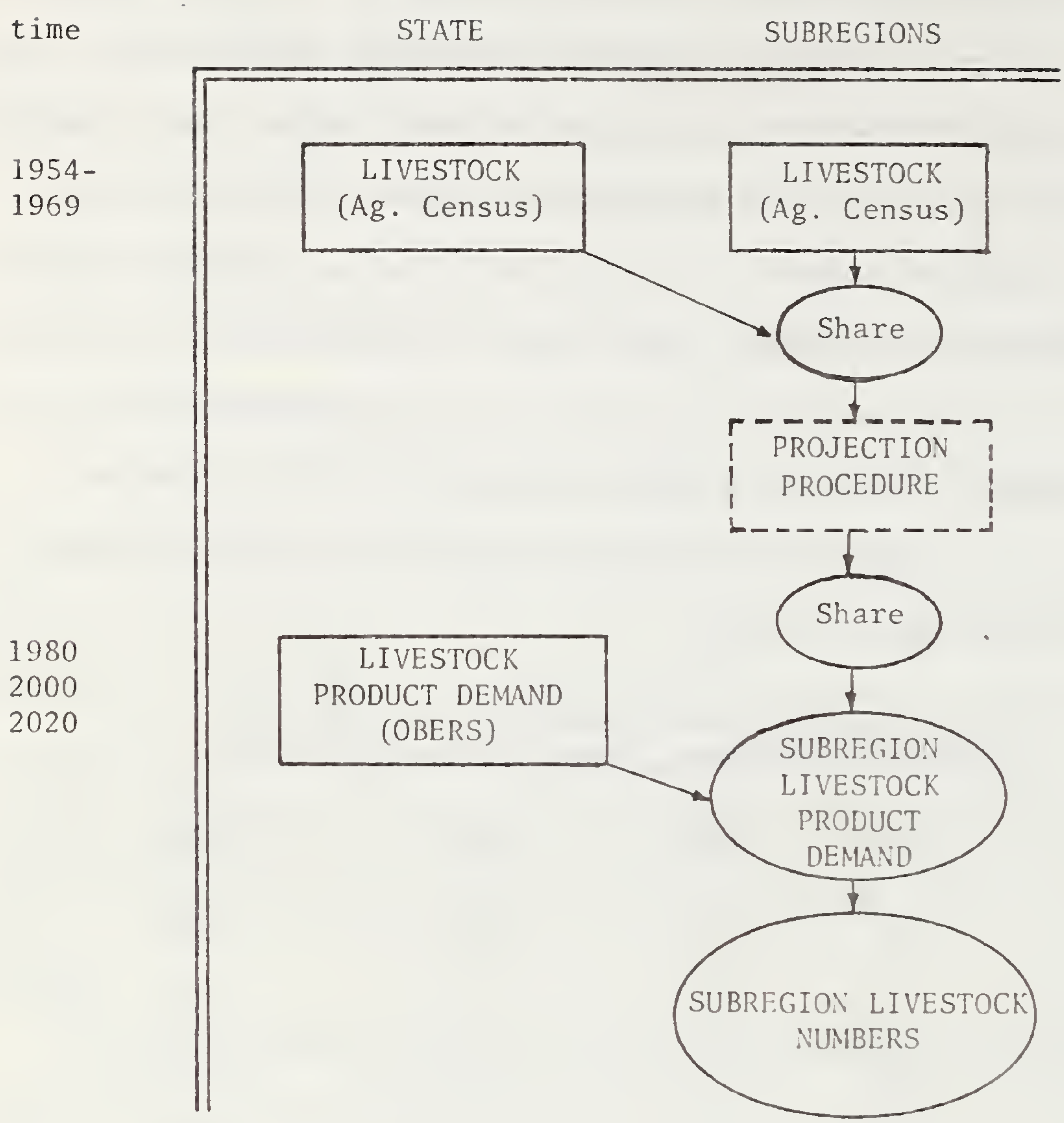


Figure 13. Projection of livestock numbers

allocated among the subregions according to their expected shares at each target date. Applying a numbers coefficient to projected livestock product demands gave an estimate of the numbers of livestock needed to meet that demand. An exception to this procedure was the estimation of beef cattle numbers. The dairy cow population is expected to contribute salvage, heifers, and veal calves to the supply of beef. The feedlot beef population was estimated only after such dairy components were subtracted from beef demand allocated to each subregion.

Tabular data reflecting livestock numbers by subregion are provided in Appendix B. These data will be used later in Chapter VI for an evaluation of livestock water use. Numbers are presented for hogs and pigs, milk cows, cattle and calves, chickens, broilers, sheep and lambs, and turkeys.

CHAPTER IV. POPULATION PROJECTIONS AND DISTRIBUTION

The purpose of this chapter is to discuss the projection of farm population and the disaggregation of total projected population into its rural and urban components. Several sources of data were brought together for this purpose; each with its own background. Therefore, the precision of the final product must suffer, but to the extent that the three components are used for comparative purposes, and not precise estimates, they are sufficient.

Total Population

Projections of total population were made by the Office of State Planning and Development using cohort survival techniques and the assumption that migration is related to employment opportunities.[1/] Due to the migration assumption, population projections were first made for labor market areas and then disaggregated to the county level. The Department of Environmental Resources further disaggregated county populations by county portions of the twenty subregions based solely on areal share. Population projections by the state were for the target years 1980, 1985, and 1990. These are compared with OBERS Series C and E projections for the State of Pennsylvania in Figure 14. In 1990, the Series C population is 14,936,000, Series E is 13,415,000, and the state projection calls for 13,385,200 people. OBERS projections are for 1980, 1990, 2000 and 2020. Both the C and E level projections exceed the state's estimates

---

[1/] Office of State Planning and Development, "Pennsylvania Projection Series Summary," No. 73 PPS-1, November 1973.

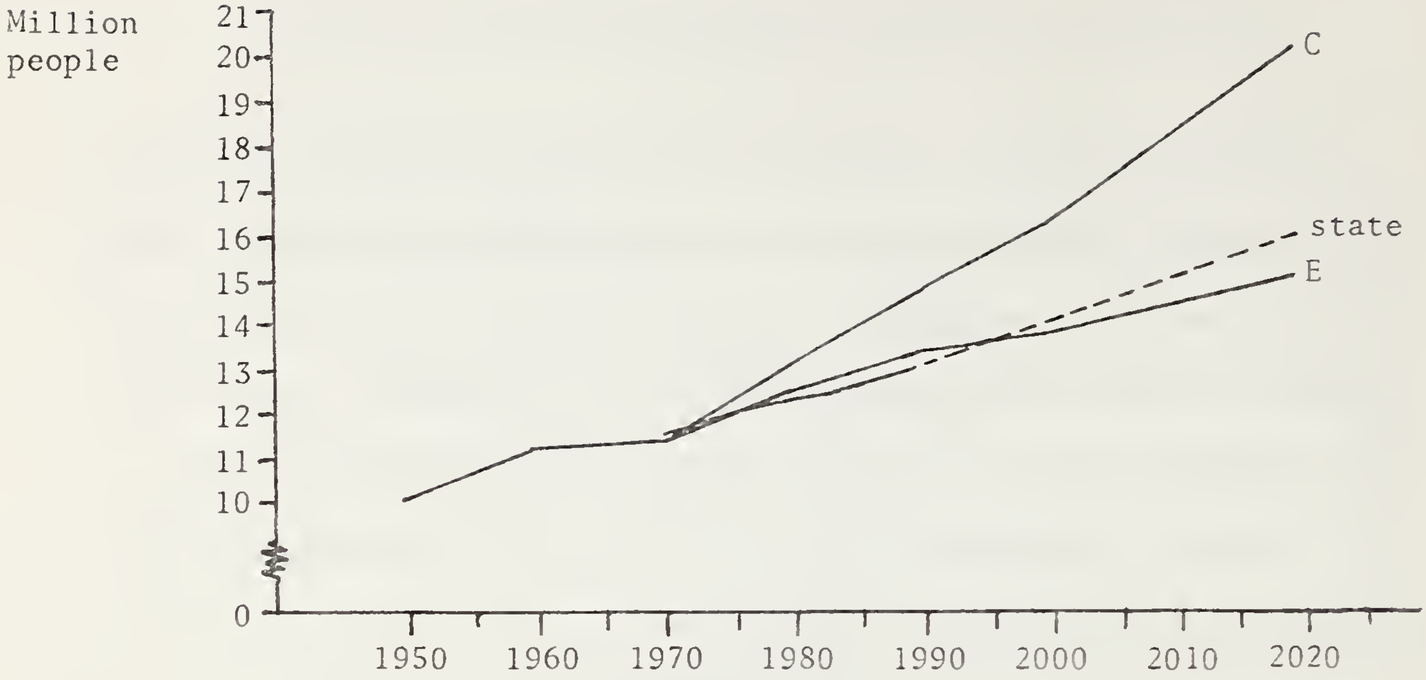


Figure 14. Comparison of OBERS Series C and E population projections with state projections.

until the year 1990, beyond which an extrapolation of the state projection rises slightly above the Series E level.

Series E population projections have only recently been adopted by the Water Resources Council for national water resources planning purposes.[1] They assume a birth rate which will eventually result in no further population growth except for immigration, while the Series C assumes birth rates which, though somewhat lower than the experience of the early 1960's, were still higher than the experience of the late 1960's and early 1970's. Consequently, the Series E projections reflect an 11.3 percent reduction from Series C national population numbers for the year 1990. For the State of Pennsylvania, the difference in the two series is slightly greater at 11.6 percent.

---

[1] The Census Bureau published Series E population projections in December, 1972 in the Current Population Report P-25, No. 493. Previously used Series C projections were published in December, 1967.

The Office of State Planning projections are based upon two different fertility assumptions: between 1970 and 1975 an average of Series D and E, or approximately 2300 total births per 1000 women in their lifetime; and from 1975 to 1990 the E level of 2100 total births.[1] Since the OBERS projections are based upon the Census concept of a trend to a specific level of total births by the year 2005, they are higher at the outset than the state's projections which assume the level has already been attained for the specific projection period. This is the major reason why the state and OBERS E projections converge beyond 1990.

Since only OBERS population projections cover all target years, these were used for disaggregation purposes rather than state projections. The same proportional relationships exist among subregions for each set of projections so that they may be factored up or down depending upon what level of total population is chosen.

Population Distribution

Two rather basic phenomena control the future distribution of Pennsylvania population. First, the current and historical location of population establishes the base from which any change may occur. Any forces acting to influence changes in the distribution will have a greater impact the farther a projection is in the future. The second, and perhaps the greater controlling factor, is the presence or absence of future employment.

The Office of State Planning first undertook to estimate future employment levels. This was done for forty-eight labor market areas. Population was derived from these estimates through an employment/population ratio that relates the average number of people dependent upon each job holder to the level of expected employment. The population in each labor market area was then proportioned into the counties comprising these areas. A further reaggregation of population to the twenty subregions was accomplished through a direct proportioning based upon relative areas (Table 2). Thus total subregional population and the urban/rural breakdowns which follow are purely mechanical constructions and should be viewed only as approximations.

---

[1] Office of State Planning and Development, "Pennsylvania Projection Series Population and Labor Force," Report No. 73 PPS-3, November 1973.

Subregion 3, dominated by the Philadelphia metropolitan area, and subregions 18, 19, and 20, which share the Pittsburgh population contain the major proportion of Pennsylvania population now and in the future. This is where the jobs have been and are anticipated to be in the future, thus the population is located there also. Only subregion 5 is expected to show a slight loss in population under the Series C projections, which are substantially above the state levels. In addition to 5, subregions 8, 11, and 14 are expected to experience declining populations under the Series E assumptions.

Projection Procedure[1/]

This part of the study addressed itself to the component parts of subregional population. The objective was to disaggregate total population into its urban, rural nonfarm, and rural farm components. Total population distributions by subregion were accepted as given by the

---

[1/] See Appendix B for a detailed tabular data used in making projections.

Table 2 -- Total population, historical and projected numbers by subregion

State and Subregion	Historical			Projections							
				Series C				Series E			
	1950	1960	1970	1980	1990	2000	2020	1980	1990	2000	2020
	Thousands										
1	159.5	169.7	183.2	211.4	236.3	263.8	326.8	199.0	212.3	224.7	246.0
2	572.9	744.4	871.1	1,103.9	1,328.2	1,557.3	2,100.5	1,039.4	1,193.0	1,326.7	1,580.8
3	3,324.0	3,623.3	3,806.9	4,315.5	4,829.7	5,334.2	6,560.9	4,063.0	4,337.4	4,544.2	4,937.5
4	221.5	216.8	224.5	242.5	259.9	275.7	317.8	228.4	233.5	234.9	239.2
5	551.5	499.0	494.7	498.0	497.8	495.8	496.0	468.9	447.1	422.4	373.3
6	252.9	253.9	257.5	283.1	304.5	326.0	383.2	266.6	273.5	277.8	288.4
7	854.7	998.5	1,135.2	1,379.8	1,617.0	1,856.5	2,442.4	1,299.2	1,452.4	1,581.6	1,838.2
8	209.7	207.2	198.5	211.1	217.2	221.2	238.1	198.8	195.1	188.4	179.2
9	113.5	123.4	136.1	159.1	179.8	202.0	256.3	149.8	161.5	172.1	192.9
10	136.9	141.8	145.7	162.2	178.8	192.6	231.5	152.8	160.6	164.0	174.2
11	204.4	238.3	202.6	217.8	229.1	239.0	262.2	205.1	205.7	203.6	197.3
12	87.3	89.2	92.1	102.4	110.7	119.9	136.5	96.4	99.4	102.1	102.7
13	111.1	124.9	137.6	163.5	187.7	211.3	271.2	153.9	168.6	180.0	204.1
14	1.5	1.5	1.5	1.6	1.7	1.7	1.9	1.5	1.5	1.4	1.4
15	119.5	135.4	142.4	167.6	190.7	214.3	271.5	157.8	171.3	182.5	204.3
16	357.9	376.4	382.5	429.0	467.8	504.4	600.1	403.9	420.2	429.7	451.7
17	220.7	218.5	215.5	229.8	240.6	257.7	282.2	216.4	216.1	219.5	212.4
18	916.5	974.2	973.5	1,093.3	1,189.5	1,282.3	1,512.3	1,029.5	1,068.4	1,092.4	1,138.2
19	915.9	941.3	923.8	1,013.6	1,080.7	1,145.5	1,312.0	954.4	970.7	975.8	987.4
20	1,166.3	1,278.0	1,269.0	1,448.8	1,588.3	1,725.8	2,064.6	1,364.2	1,426.7	1,470.2	1,553.8
State Total	10,498.0	11,320.6	11,793.9	13,434.0	14,936.0	16,427.0	20,068.0	12,649.0	13,415.0	13,994.0	15,103.0

Source: U.S. Census of Population and U.S. Water Resources Council OBERS Projections.

state projections. Projections of urban and rural farm population were made and rural nonfarm components were derived as a residual.

Farm Population

The derivation of farm population follows the procedure discussed in Chapter III and is essentially as represented in Figure 15, in which exogeneously given data are in squares, calculations are encircled, and the projection technique is labeled PROJECTION PROCEDURE. Inputs consisted of Agricultural Census data (1954-69) for land in farms and number of farms at the state and county levels; Population Census data (1950-70) for farm population at the state and county levels; and OBERS projections (used as control totals) for state land in farms in the target years. All county data were aggregated into subregional groupings before reporting.

The procedure estimates how a given state total of the variable in question will be disaggregated in a future year, based upon how it has been distributed in the past. At the county level, the first step was to calculate its historical share of the state total for the years that data were available. This share ordinarily changes with time and can be plotted on an ordinate against time on the abscissa giving the share of the state total that a county is expected to produce in the future. The projected county share, applied to the given projection of state totals (from OBERS), gives the value of the variable for that county in target years. A subroutine of the procedure ensures that the sum of the county shares in any year does not exceed 100 percent of the state total.

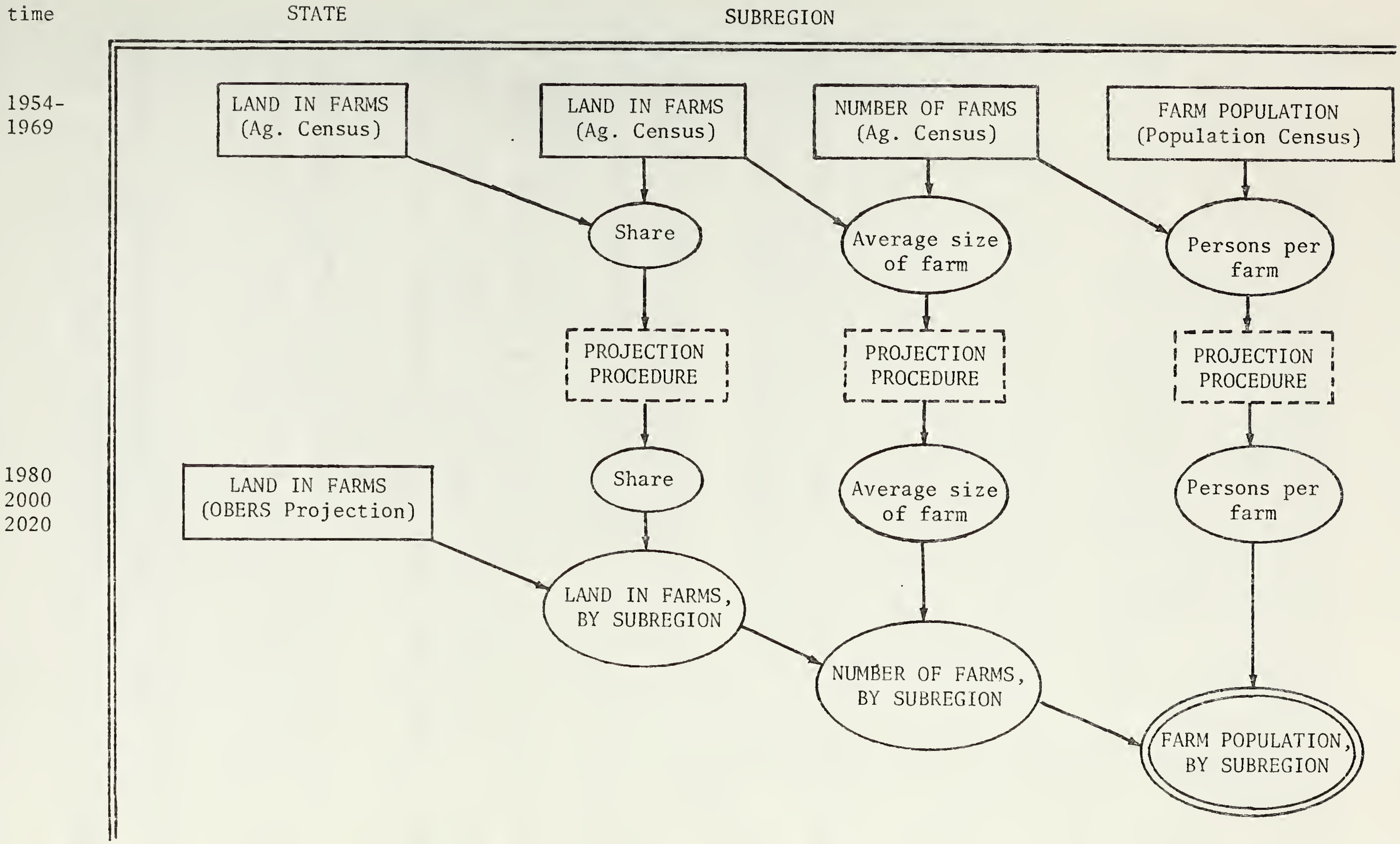

time
STATE
SUBREGION
1954-
1969
1980
2000
2020
LAND IN FARMS (Ag. Census)
LAND IN FARMS (Ag. Census)
NUMBER OF FARMS (Ag. Census)
FARM POPULATION (Population Census)
Share
Average size of farm
Persons per farm
PROJECTION PROCEDURE
PROJECTION PROCEDURE
PROJECTION PROCEDURE
LAND IN FARMS (OBERS Projection)
Share
Average size of farm
Persons per farm
LAND IN FARMS, BY SUBREGION
NUMBER OF FARMS, BY SUBREGION
FARM POPULATION, BY SUBREGION

Figure 15. Projection of farm population

Farm population was projected through three intermediate steps, as depicted in Figure 15: first, land in farms for each subregion was estimated; second, average size of farm was projected and, when combined with land in farms, gave the number of farms; and third, persons per farm were derived and combined with farm numbers to estimate farm population.

The first step in the estimation was the projection of land in farms for each county. By this procedure, future land in farms at the state level was disaggregated into county land in farms according to the projected shares of each county. Data used were historical state and county census figures for land in farms and OBERS projected state land in farms. County projections were then converted to subregions by proportioning.

Historical shares were derived by dividing county land in farms into state total land in farms for each of the census years. A Spillman extrapolation (PROJECTION PROCEDURE) was performed on the trend of historical shares to estimate future shares accounted for by each county. The projected shares of land in farms were applied to the OBERS projected state totals (used as the control) to estimate future land in farms by county for target date years.

In the second step of the procedure, the average size farm for each county was projected and combined with land in farms to derive farm numbers in each county. Data used were historical census figures for land in farms and farm numbers.

Historical county land in farms was divided by the corresponding number of farms to derive the historical average size farm for each subarea. A Spillman extrapolation was performed from which estimates of the average farm size for each target date were obtained. At this point the estimates (from step 1) of land in farms were introduced, were divided by average farm size, and an estimate of farm numbers by subregion was derived for each of the target dates.

The third step of the procedure was the estimation of persons per farm -- a figure which, when combined with numbers of farms from the previous step, gave target date estimates of farm population in each subregion. Data used were farm numbers from the Agricultural Census and rural farm population from the Population Census.[1/]

Each county's farm population was divided by its farm numbers to give average farm family size over the historical period. On the basis of these numbers, a Spillman extrapolation was performed giving projected persons per farm for the target dates. Finally, these target date estimates of persons per farm were multiplied by estimates of farm numbers from the second step to estimate rural farm population (Table 3).

Urban Population

The derivation of urban population followed a much abbreviated form of the above procedure without benefit of exogenous control totals at the state level. Census of Population state and county figures for 1950, 1960, and 1970 were the only data used.

Total population and urban population data were collected for each county and the state. Calculations were made of the percentage urban

---

[1/] Because of imperfect overlap, the 1949, 1959, and 1969 agricultural census data was linked with population data for 1950, 1960, and 1970.

Table 3 -- Rural farm population, historical and projected numbers by subregion

State and Subregion	Historical			Projections							
				Series C				Series E			
	1950	1960	1970	1980	1990	2000	2020	1980	1990	2000	2020
	Thousands										
1	24.5	10.0	5.6	3.5	2.8	2.0	1.4	3.3	2.5	1.7	1.0
2	39.5	16.8	10.3	6.5	5.0	3.6	2.4	6.1	4.6	3.1	1.8
3	64.0	33.0	21.2	14.5	11.9	9.2	6.6	13.8	10.8	7.8	4.9
4	42.7	25.3	14.4	10.6	8.7	6.8	4.9	10.0	7.9	5.8	3.7
5	24.7	12.2	7.3	4.8	3.9	3.0	2.1	4.5	3.5	2.6	1.6
6	22.6	13.6	8.1	5.9	5.0	4.1	3.1	5.6	4.5	3.5	2.3
7	115.3	77.5	60.5	49.0	43.8	38.5	31.2	46.1	39.8	32.7	22.9
8	20.5	7.1	7.1	2.5	1.9	1.4	0.9	2.4	1.8	1.2	0.7
9	15.7	9.1	5.8	4.5	3.8	3.0	2.2	4.2	3.4	2.6	1.7
10	17.4	10.3	6.1	4.4	3.7	3.0	2.2	4.2	3.4	2.6	1.7
11	23.0	11.9	6.8	4.9	4.0	3.2	2.4	4.6	3.6	2.7	1.8
12	17.9	11.3	7.0	5.1	4.2	3.3	2.4	4.8	3.8	2.9	1.8
13	25.3	15.9	9.1	6.9	5.7	4.6	3.5	6.5	5.2	3.9	2.6
14	0.5	0.3	0.2	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.0
15	11.8	3.3	3.0	2.0	1.7	1.4	1.1	1.9	1.5	1.2	0.8
16	50.0	19.5	10.5	7.2	5.7	4.2	2.9	6.8	5.2	3.6	2.1
17	38.1	15.6	7.3	5.6	4.5	3.5	2.5	5.2	4.1	3.0	1.9
18	40.4	16.7	10.0	6.5	5.2	3.8	2.6	6.2	4.7	3.3	1.9
19	48.6	19.0	10.1	7.8	6.4	5.0	3.6	7.4	5.8	4.3	2.7
20	62.6	27.7	15.0	10.8	8.9	7.0	5.1	10.2	8.1	6.0	3.8
State Total	705.2	356.3	225.2	163.1	136.9	110.7	83.1	153.9	124.3	94.6	61.7

Source: U.S. Census of Population.

in historical time periods and projected using the Spillman technique. Projected state urban population was derived from an application of the projected urban percentage to OBERS Series C and E population projections for the state. Total urban population then served as an upper bound on the sum of subregional urban populations in projected target years (Table 4).

Rural Nonfarm Population

Rural nonfarm population was derived from Population Census figures for historical time periods and direct calculation for projected target dates. Once urban and rural-farm population figures were determined through the above procedures they were simply subtracted from total population figures. The residual represents rural nonfarm population and should be considered consistent with the Census of Population definition of persons not residing in urban places, places of 2,500 or more population, or on farms (Table 5).

Table 4 -- Urban population, historical and projected numbers by subregion

State and Subregion	Historical			Projections							
				Series C				Series E			
	1950	1960	1970	1980	1990	2000	2020	1980	1990	2000	2020
	Thousands										
1	92.2	93.1	99.7	110.0	120.4	131.1	157.1	103.6	108.0	111.7	118.3
2	379.9	552.3	653.0	880.4	1,095.4	1,314.7	1,835.3	828.9	982.9	1,119.9	1,381.2
3	2,960.1	3,261.4	3,392.4	3,856.1	4,319.9	4,781.7	5,871.0	3,630.8	3,876.1	4,073.4	4,418.5
4	116.0	105.9	102.2	102.2	101.2	99.9	99.0	96.2	90.8	85.1	74.5
5	437.5	385.0	367.9	357.1	344.3	331.0	309.5	336.2	308.9	282.0	232.9
6	155.8	147.7	146.0	154.3	161.3	168.8	192.7	145.3	144.7	143.8	145.0
7	465.3	540.8	638.1	778.8	922.5	1,069.5	1,429.9	733.2	827.7	911.1	1,076.1
8	93.7	91.8	87.4	91.8	93.7	94.9	101.3	86.4	84.0	80.8	76.2
9	49.1	51.8	58.6	67.7	76.7	86.4	110.1	63.7	68.9	73.6	82.9
10	76.0	72.3	73.3	77.2	81.1	84.3	93.7	72.7	72.8	71.8	70.5
11	114.3	108.0	105.6	108.4	110.3	111.0	114.1	102.0	99.0	94.6	85.8
12	23.0	21.6	19.5	19.5	18.9	18.4	17.4	18.4	17.0	15.7	13.1
13	34.0	35.7	35.3	38.0	39.6	40.1	42.0	35.8	35.5	34.2	31.6
14	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2
15	88.3	101.0	103.0	120.1	134.9	149.6	185.5	113.1	121.0	127.5	139.6
16	189.4	195.7	188.7	205.3	217.2	228.4	259.6	193.3	194.9	194.6	195.4
17	67.8	64.5	60.2	61.7	62.0	62.5	65.0	58.1	55.6	53.2	48.9
18	647.9	728.4	729.9	838.9	926.4	1,012.3	1,222.0	789.9	831.2	862.4	919.7
19	570.4	629.1	635.9	724.2	795.4	864.7	1,033.8	682.0	713.6	736.7	778.0
20	842.0	916.7	930.5	1,054.1	1,153.6	1,249.4	1,483.8	992.6	1,035.0	1,064.3	1,116.7
State Total	7,403.0	8,102.9	8,427.4	9,646.1	10,775.1	11,898.9	14,623.0	9,082.4	9,667.8	10,136.6	11,005.1

Source: U.S. Census of Population.

Table 5 -- Rural nonfarm population, historical and projected numbers by subregion

State and Subregion	Historical			Projections							
				Series C				Series E			
	1950	1960	1970	1980	1990	2000	2020	1980	1990	2000	2020
	Thousands										
1	42.8	66.6	77.9	97.9	113.2	130.7	168.3	92.2	101.7	111.3	126.7
2	153.5	175.3	207.8	217.1	227.7	239.1	262.8	204.4	205.5	203.6	197.8
3	299.8	328.9	393.3	444.0	497.8	573.5	683.5	418.3	450.7	462.9	514.3
4	62.8	85.6	107.8	129.7	150.0	169.0	213.8	122.1	134.8	144.0	161.0
5	89.3	101.7	119.6	136.1	149.7	161.8	184.4	128.2	134.7	137.9	138.8
6	74.5	92.6	103.4	122.9	138.2	153.1	187.4	115.7	124.2	130.4	141.1
7	274.0	380.3	436.6	552.0	651.1	748.5	981.1	519.8	585.3	637.6	738.8
8	95.5	108.2	104.0	116.8	121.6	124.9	135.8	110.0	109.3	106.4	102.2
9	48.7	62.6	71.8	86.9	99.3	112.6	143.9	81.8	89.3	95.9	108.3
10	43.4	59.3	66.3	80.6	94.0	105.2	135.6	75.9	84.5	89.6	102.0
11	67.1	83.4	90.2	104.6	114.7	124.8	145.8	98.5	103.1	106.3	109.7
12	46.4	56.3	65.6	77.7	87.6	98.1	116.7	73.2	78.6	83.6	87.9
13	51.8	73.3	93.3	118.7	142.3	166.6	225.7	111.7	127.8	141.9	169.9
14	0.8	1.0	1.1	1.2	1.3	1.4	1.6	1.2	1.2	1.2	1.2
15	19.4	31.1	36.4	45.5	54.1	63.2	84.9	42.8	48.7	53.9	63.9
16	118.5	161.2	183.3	216.5	244.9	271.8	337.7	203.8	220.1	231.5	254.2
17	114.7	138.4	148.0	162.5	174.0	191.8	214.7	153.0	156.3	163.3	161.6
18	228.1	229.0	233.6	247.9	257.8	266.1	287.8	233.4	232.4	226.7	216.6
19	296.9	293.2	277.8	281.6	278.9	275.8	274.7	265.2	251.2	234.9	206.8
20	261.6	333.6	323.6	383.8	425.8	469.4	575.8	361.4	383.5	399.9	433.4
State Total	2,389.8	2,861.4	3,141.3	3,624.8	4,024.0	4,417.4	5,362.0	3,412.6	3,622.9	3,762.8	4,036.2

Source: U.S. Census of Population.

CHAPTER V. EMPLOYMENT

The purpose of this chapter is to briefly describe and compare the procedures used by the Pennsylvania Office of State Planning and Development and OBERS to derive future employment estimates. Employment estimates by occupation at the state level are compared. An alternative method for developing estimates for agricultural employment is also discussed and the results are presented for each of the twenty subregions.

Projection Procedure

State Planning

The Pennsylvania Office of State Planning and Development projects employment using a sophisticated methodology which was created for them by the National Planning Association (NPA). Thus, state level estimates are closely related to national projections made by NPA, which are also similar to those established in the OBERS procedures.

The procedure used by Pennsylvania links employment to population through age specific birth rates, five-year age-sex specific survival rates, and labor force migration rates. Essentially, population is projected at the state level and 48 labor market areas within the state. Its age-sex structure is determined in five year increments. Through an application of a labor force participation rate for each age-sex increment, a labor force supply is derived for each labor market area in the state. Labor force demand estimates are made for each labor market area by industry. The difference between the resident labor force supply and labor force demand represents migration of the labor force, which then finds its way into the next round of population projections.

OBERS

The OBERS procedure is conceptually similar but much less detailed in terms of population data. The working age population is simply a subset of the total population. Through assumptions about labor force participation rates by males and females, the size of the armed forces, and the unemployment rate, civilian employment is derived.

In order to relate future employment to individual industry at the regional level, it is necessary to first project economic activity by industry at the national level. The national income and product accounts are used for this step and result in employment by industry at the national level, both in numbers and 1967 constant dollar earnings. Disaggregations of industrial detail back to the state level are in terms of total earnings of workers in 1967 constant dollars.

Comparison of Results

Labor force and employment, as derived by the state procedure, are compared with employment from OBERS in Table 6. Notice that employment exceeds labor force. Although this at first appears to be an error in the data, it is quite understandable for a state like Pennsylvania which draws a substantial segment of its labor force from surrounding states. The state's labor force and its employment are projected to draw farther apart over time reaching nearly half a million disparity by 1990.

In the OBERS procedure comparable employment levels for both C

Table 6--Historic and projected labor force and employment, Pennsylvania

Method	1970	1980	1990	2000	2020
	-Thousands-				
State labor force[1]	4,729.9	5,200.1	5,569.4		
State employment[2]	4,870.6	5,429.9	5,968.8		
OBERS employment "C"[3]		5,213.8	5,768.7	6,525.9	8,094.8
OBERS employment "E"[3]	4,594.3	5,401.6	5,798.7	6,289.0	6,739.3
Population Census employment[4]	4,536.9				

[1] Report No. 73 PPS-3 Pennsylvania Population and Labor Force, Harrisburg, November 1973
[2] Report No. 73 PPS-2 Employment, Harrisburg, November 1973
[3] OBERS Projections, 1972
[4] 1970 Census of Population

and E series are slightly below state levels. Since state population projections are below the OBERS estimates, this either implies a higher assumed labor force participation rate or influence from the detailed age-sex structure of the state projections. The results are surprisingly close given the different methods of projecting.

OBERS Series E projections assume higher participation rates by females due to lower fertility rates. A faster decline in the number of hours worked per year per employee was also assumed in Series E. This explains much of the difference between the OBERS C and E estimates in 1980 and 1990. Beyond those years the divergence is principally due to the more rapid increase in Series C population.[1]

Projections by Industry

When total employment is projected by industry some interesting adjustments are observed (Table 7). In the state projections the total employment level is expected to rise by about 23 percent over the twenty-year period 1970 to 1990. However, two-thirds of that increase is expected to occur in services and government employment alone. Significant declines are expected in agriculture and mining while employment in food processing, textiles, apparel, and petroleum refining is also projected to decline moderately. The remaining industries share the employment gains and those with the closest contact with the public seem to gain the most.

---

[1] Comparison of the above employment estimates with Population Census data for 1970 shows considerable difference in state employment. However, census data on employment are derived by asking individuals, at their residence, if they are employed. The employment estimates by State Planning and OBERS are derived through a process that determines employment at place of work and includes participation from outside the state.

Table 7--Historic and projected employment by industry, state of Pennsylvania

Industry	1969	1970	Projections 1975	1980	1985	1990
	- - - - - -	- - - - - -	- - -Thousands	- - - - - -	- - - - - -	- - - - - -
Total Employment	4,877.2	4,870.6	5,151.1	5,429.9	5,691.5	5,968.8
Agriculture, forestry, fisheries	88.9	87.9	65.2	49.5	41.3	35.8
Mining	40.1	40.8	36.0	32.2	29.7	28.5
Contract construction	244.1	237.8	255.9	272.4	287.4	303.1
Manufacturing	1,580.0	1,520.3	1,540.4	1,585.0	1,625.0	1,667.0
Food and kindred products	115.0	115.0	115.5	113.7	111.8	110.0
Textile mill products	70.6	66.2	66.0	62.6	59.6	57.2
Apparel and other fab.prod.	178.5	170.7	170.5	169.8	169.0	168.5
Lumber prod. and furniture	45.6	43.7	48.4	52.3	55.4	58.8
Paper and allied products	50.5	50.7	52.6	55.1	57.5	59.9
Printing and publishing	72.4	71.8	72.5	74.5	76.4	78.3
Chemicals and allied products	65.2	64.7	66.8	69.2	71.6	74.1
Petroleum refining	19.5	19.6	18.9	17.7	16.5	15.5
Primary metals	242.2	232.5	239.3	242.7	245.6	248.5
Fabricated metals and ordnance	136.9	124.6	122.5	127.7	132.6	137.6
Machinery excluding electrical	140.3	137.3	138.1	148.6	158.2	166.6
Electrical machinery, supplies	157.4	149.4	146.8	154.7	161.7	167.9
Transportation equipment	83.3	76..6	81.0	92.2	102.2	113.0
Other manufacturing						
Trans., Comm. and Public Utilities	277.6	279.5	280.9	281.1	280.4	281.3
Wholesale and Retail Trade	948.5	961.6	1,031.4	1,065.6	1,095.1	1,124.9
Finance, Insurance, and Real Estate	195.4	201.9	218.1	231.7	244.0	256.9
Services	902.9	926.4	1,007.1	1,096.6	1,182.0	1,276.0
Government	599.7	614.4	716.1	815.8	906.6	995.3

Source: Report No. 73 PPS-2, Employment, Harrisburg, November 1973

Table 8 presents the OBERS version of these projections. Because OBERS national employment projections were developed along with industrial growth in terms of productivity and income, they were disaggregated to the state level in terms of earnings by industry. To get these data into comparable terms for comparison with the State Planning data, earnings per employee in each industry were determined at the national level. This was possible because future employment by industry was reported for the U.S., along with industrial earnings. (At the state level the only comparative value was per capita income; this could not be used to differentiate among industries, let alone individuals.)

Because there are many implicit assumptions in this procedure, most of which are not immediately obvious, the number of employees by industry should not be expected to agree with the state projections. Nevertheless, trends apparent in the state data should also show up in the OBERS data, if the general procedures are consistent. While the OBERS results generally indicate a lower level of employment for Pennsylvania, the number of workers in manufacturing and services are significantly higher and government employees are only half as large (Table 8). Some of the difference is obviously due to the assumption that national income per employees by industry are identical to income levels of Pennsylvania employees. This would tend to indicate that OBERS employment levels are overstated. An additional problem may be due to the way the two procedures classify workers by industry. Some employees may be counted in different industries in the aggregations of the two methods.

Table 8- Historic and Projected employment by industry, State of Pennsylvania.

Industry	1969	Projections							
		Series C				Series E			
		1980	1990	2000	2020	1980	1990	2000	2020
	Thousands								
Total Employment	4,511.9	5,322.8	5,873.3	6,689.7	8,313.2	5,457.2	5,861.3	6,361.7	6,821.0
Agriculture, Forestry and Fisheries	64.1	49.3	40.3	35.9	34.9	49.0	40.6	34.7	25.5
Agriculture	63.5	48.8	39.9	35.5	34.6	48.4	39.9	34.0	24.8
Forestry and Fisheries	0.5	0.5	0.4	0.4	0.4	0.6	0.6	0.7	0.7
Mining	41.1	36.2	32.5	29.7	25.5	38.3	33.2	29.9	24.0
Contract Construction	268.7	325.4	362.4	412.7	513.0	313.1	324.2	345.8	365.5
Manufacturing	1,483.2	1,775.0	1,864.3	2,061.9	2,402.4	1,586.0	1,592.0	1,622.0	1,587.6
Food and kindred products	114.6	113.5	111.1	108.7	104.1	112.1	103.4	96.1	80.3
Textile mill products	61.8	59.1	51.8	45.9	37.1	50.4	40.5	34.9	26.1
Apparel and other fabric products	148.7	160.5	159.3	157.2	152.0	152.5	144.1	138.1	119.4
Lumber products and furniture	39.5	47.5	48.5	49.4	51.1	40.7	39.5	38.5	34.3
Paper and allied products	44.6	54.0	60.5	69.2	87.7	53.4	56.5	59.9	61.2
Printing and publishing	73.6	99.8	107.1	118.4	141.4	88.2	94.4	101.4	106.0
Chemicals and allied products	56.9	80.7	62.4	107.5	137.4	68.2	75.0	82.6	94.3
Petroleum refining	27.2	27.3	27.5	27.7	28.2	26.4	24.2	22.8	20.6
Primary metals	226.5	248.8	240.8	233.6	220.9	198.5	171.7	153.5	122.5
Fabricated metals and ordnance	122.6	158.6	185.1	219.6	292.1	141.6	146.7	152.8	153.2
Machinery, excluding electrical	132.6	175.3	196.5	225.2	282.2	147.9	154.5	159.3	157.8
Electrical machinery and supplies	153.0	216.0	249.9	292.1	371.9	193.8	220.5	249.6	282.1
Motor vehicles and equipment	21.6	29.2	33.2	38.6	49.5	21.3	22.7	23.9	24.8
Trans. equip., excluding motor vehicles	52.3	67.0	74.8	85.6	108.1	53.0	53.1	51.9	46.9
Other manufacturing	207.7	237.7	255.9	283.2	338.6	238.2	245.3	256.5	258.1
Transportation, Comm. and Public Utilities	299.2	329.9	355.1	391.7	465.8	342.9	364.6	391.6	422.3
Wholesale and Retail Trade	834.5	921.0	1,015.6	1,146.6	1,408.7	1,043.4	1,091.6	1,138.9	1,102.4
Finance, Insurance and Real Estate	183.9	207.9	234.9	270.6	341.9	262.3	301.7	344.9	394.3
Services	1,103.0	1,355.7	1,605.6	1,921.3	2,576.0	1,549.6	1,798.1	2,103.2	2,487.5
Government	234.1	322.3	362.6	419.2	545.0	272.6	315.3	350.8	412.2
Civilian	201.4	288.8	329.1	385.7	511.5	246.6	289.4	324.8	386.3
Armed Forces	32.7	33.5	33.5	33.5	33.5	26.0	26.0	26.0	26.0

Source: Data derived from OBERS projections, 1972.

The Agricultural Sector

With the exception of the above industries, the same general trends in employment identified by State Planning in their projections are also observed in OBERS. Due to the limitations of the data, no attempt has been made to further disaggregate the OBERS employment data to subregions or to the 48 state labor market areas for comparison purposes. However, the number of full time equivalent farm employees were estimated by subregion (Table 9).

The procedure used in developing full time equivalent farm workers relied on labor productivity rates by crop and type of livestock. These were applied to projected acreage of individual crops and numbers of each class of livestock and then converted to full time equivalents through use of average number of hours worked per year. Projections of employees by this method must be higher than comparable values derived by any method relying on historical data that are reported by place of employment. Since an employee is counted in only one place for employment statistics, that place which yields him his greatest source of income is his place of employment. This method underestimates the total employment in agriculture and does not count farm labor performed by those counted elsewhere or most farm family labor. Relating farm labor to total agricultural output provides a much more accurate picture of employment in the agricultural industry.1/

1/ To put these estimates in perspective, the total number of full time equivalent employees (at the state level) translate into 1.3, 1.7, 1.8, and 1.9 employees per farm in 1969, 1980, 2000, and 2020 respectively.

Table 9--Historical and projected number of full time farm employees per year

State and Subregion	1969	Projections					
		Series C			Series E		
		1980	2000	2020	1980	2000	2020
	numbers						
1	1,957	1,978	1,413	971	1,883	1,212	724
2	3,258	2,814	1,721	1,141	2,660	1,488	859
3	7,318	6,658	4,675	3,410	6,333	4,035	2,573
4	5,694	5,539	4,036	2,768	5,263	3,452	2,060
5	2,675	2,575	1,971	1,595	2,462	1,706	1,200
6	4,155	3,668	3,796	3,303	3,507	3,268	2,472
7	27,748	33,115	29,168	26,060	31,315	25,376	19,804
8	1,162	1,363	1,165	1,027	1,276	999	766
9	1,830	2,130	1,721	1,362	2,025	1,515	1,015
10	2,065	2,248	1,816	1,498	2,150	1,572	1,127
11	2,238	2,461	2,029	1,554	2,340	1,740	1,157
12	2,978	3,339	2,696	2,144	3,163	2,317	1,600
13	4,124	4,481	3,804	3,217	4,208	3,317	2,406
14	52	51	46	34	49	39	25
15	1,006	1,012	881	742	971	792	556
16	3,044	2,982	2,220	1,618	2,845	1,922	1,207
17	2,189	2,124	1,616	1,215	2,025	1,386	905
18	2,989	3,014	2,349	1,852	2,849	2,015	1,372
19	2,729	2,472	1,741	1,211	2,355	1,487	899
20	4,129	3,665	2,567	1,861	3,498	2,201	1,387
State Total	83,340	87,689	71,431	58,583	83,177	61,839	44,114

Source: U.S. Department of Agriculture, Agricultural Statistics, 1972, and data developed by ERS.

The rate of decline in farm employment is expected to slow from the precipitous drop experienced since World War II. Labor saving technology will still be adopted in the years to come, but as farms enlarge, more product per acre is derived, and employees work fewer hours, the requirements for farm workers will gradually rise per farm.

CHAPTER VI. AGRICULTURAL WATER USE

Agricultural water use estimates were made for irrigation and livestock purposes as part of this study. The Pennsylvania Department of Environmental Resources supervised the development of these estimates by state agencies and asked that the Economic Research Service make independent estimates for comparison purposes.

Irrigation

Because application rates of one inch per week of the growing season were accepted as given by the Pennsylvania Department of Agriculture, the variable of interest became estimated acreage irrigated. County committees of agricultural experts were formed to establish the 1968 level of irrigation and to make projections of future use. Their estimates were influenced by special studies made by the Pennsylvania Crop Reporting Service in the middle 1960's and a desire to anticipate water usage under more severe situations than average weather conditions.

The county committee estimates were disaggregated to individual watersheds by the committees and then recombined for the twenty subregions. These estimates reflected all uses of irrigation; park and recreational uses in addition to agricultural (Table 10). Consequently, there is considerable difference between the acreage estimates developed under this process and those developed by the Economic Research Service. The latter were strictly for agriculture and were based solely upon historical relationships.

Table 10-Current and projected irrigated acreage by subregion

State and Subregion	1968	1980	1990
	------------	Acres	-------------
1	690	690	706
2	5,331	6,055	8,214
3	5,281	10,382	15,627
4	715	595	708
5	3,825	4,745	5,533
6	2,496	4,575	6,308
7	12,529	21,191	28,850
8	59	170	263
9	892	1,980	2,887
10	1,517	2,910	4,071
11	3,212	4,909	6,323
12	1,007	1,995	2,769
13	4,222	5,455	6,483
14	0	0	0
15	1,100	1,300	1,467
16	835	1,160	1,431
17	272	1,032	1,665
18	1,181	2,184	3,020
19	465	665	831
20	1,119	1,574	1,952
State Total	46,748	73,567	99,108

Source: Data prepared by State of Pennsylvania

The same procedure for projecting agricultural activity, described in Chapter III, was used in projecting irrigated acreage and the methodology will not be repeated here. This procedure relied upon Census of Agriculture data for five points in time from 1949 to 1969 as supplemented by the Crop Reporting Service special studies in 1966, 1967 and 1968. Severe drought conditions existed throughout Pennsylvania from 1962 through 1967. Farmers responded by increasing irrigation (Table 11). A state high of 22,734 acres were reported in the

Table 11 - Irrigation, historical and projected acreage by subregion

State and Subregion	Historical					Series C			
	1949	1954	1959	1964	1969	1980	1990	2000	2020
	- - -	- - -	- - -	- - -	-Acres -	- - -	- - -	- - -	- - -
1	9	613	445	694	472	867	1,065	1,263	1,655
2	4,145	3,743	2,711	2,939	2,467	1,418	542	0	0
3	1,006	3,420	2,100	2,989	2,392	3,341	3,787	4,228	5,098
4	17	437	376	528	225	529	629	730	930
5	160	744	689	855	893	1,328	1,641	1,953	2,574
6	214	594	556	1,165	1,031	1,636	2,075	2,512	3,384
7	957	6,009	3,545	6,188	4,053	6,826	8,100	9,374	11,923
8	20	74	126	200	177	304	391	479	653
9	88	144	363	714	212	647	810	971	1,293
10	174	332	310	638	390	676	821	966	1,252
11	66	282	201	671	1,039	1,425	1,881	2,332	3,221
12	9	168	223	594	694	1,091	1,451	1,810	2,528
13	4	692	1,054	2,014	1,714	3,087	4,035	4,984	6,880
14	6	2	2	0	0	0	0	0	0
15	52	342	432	314	198	378	431	483	588
16	94	551	530	412	323	515	578	642	767
17	21	96	296	294	458	681	893	1,104	1,523
18	63	315	376	543	905	1,238	1,613	1,984	2,718
19	48	253	260	455	261	518	643	767	1,015
20	97	507	560	528	793	1,087	1,364	1,641	2,188
State Total	7,251	17,950	16,523	22,734	18,697	27,592	32,749	38,223	50,190

Source: U. S. Census of Agriculture.

Census for 1964, and the special study for 1966 chronicled nearly 37,000 acres. However, as the drought abated, so did the use of irrigation, reaching a low of 13,200 acres in the 1967 special study.

Under the OBERS procedures, which assume normal weather conditions for future time periods, the projection of irrigated acreage based on weather extremes is not justified nor are the historical data available to permit such an undertaking. It is possible, however, that if periods of prolonged drought were to precede the projected dates of 1980, 2000, and 2020, irrigated acreages could reach the levels estimated by the state. Although the magnitudes differ, the relationships among subregions is fairly similar between the two methods used in projecting.

Livestock Water Use

The county committees also estimated numbers of each class of livestock for 1968 at the watershed level and made projections to 1980 and 2000. Values for the 1990 estimate were derived by extrapolation. The following daily usage per head was developed by the Pennsylvania Crop Reporting Service and used by ERS and the state (Table 12).

As in the estimation of future irrigation, livestock water use was projected by first estimating production in each subregion. Data used in this analysis were Agricultural Census data for livestock numbers at the state and county levels, and OBERS projections of state demands for livestock and livestock products in future years. County data were aggregated into subregion groups before use.

In this procedure the shares analysis was modified somewhat to take into account the form of OBERS state livestock projections, which were

Table 12-Estimated daily water usage by livestock class

Class	1968	1980	2000
	Gallons		
Milk Cows	35	40	50
Other cattle	12	15	15
Horses and Ponies	12	12	15
Hogs	4	6	10
Sheep	2	3	5
Poultry	0.1	0.15	0.2

in terms of market weight. Once state level estimates of market weight were allocated among subregions, two additional steps followed. First, market weights had to be converted into livestock numbers, and second, the supportive livestock population had to be considered.

Marketed livestock represent only part of the total livestock population, and they exert only part of the total livestock water demand. In order for livestock and livestock products to reach market, breeding flocks and herds are required which may also exert a substantial demand for water. In addition, not all animals are expected to reach marketable age, and those who do not also exert demand for water. It was necessary to take these portions of the livestock population into account in addition to the livestock needed to meet the demands projected by OBERS. This was done through the use of coefficients which expressed the total number of animals required to meet market demands. Given a level of market demand, the number of animals needed to meet that demand could be determined using average weight or productivity coefficients. Ratios were then developed to determine mortality, and the numbers of animals in breeding flocks and herds needed to support such marketed animals. The sum of the three components represented total livestock numbers.

Once total numbers of livestock were determined by class, they were converted to mature equivalents so as not to distort water use estimates when the rates in Table 12 were applied. All livestock water use values were converted to million gallons per day (MGD) for comparison purposes.

Given the differences in the two procedures used to estimate livestock numbers, it is surprising that such similar results were obtained (Tables 13 and 14). While there are some differences among subregions between the two estimates, values at the state level are quite close. Subregion 7, the principle livestock producing area of the state, accounts for a quarter of state estimated use and nearly a third of ERS estimated use. This appears to be the major difference in the two systems.

Because the OBERS projections only account for marketed livestock products, horses and ponies are not included in the ERS estimates of water use. This may explain some of the minor variations among subregions. However, the substantial difference in Subregion 7 is due to estimates of the poultry component. Each procedure identifies Subregion 7 as producing approximately half of the state's poultry output. But, whereas the state estimates identify poultry as a single class, the OBERS procedure makes separate estimates for chickens, broilers, and turkeys. This process resulted in a combined total somewhat larger than the state's estimates and appears to be the primary reason for the difference.

Table 13-Current and projected livestock water use by subregion

State and Subregion	1968	1980	1990
1	1.565	1.793	2.010
2	1.235	1.142	1.280
3	4.404	4.750	4.954
4	4.947	5.759	6.594
5	1.073	1.248	1.430
6	1.671	2.408	2.989
7	10.959	13.704	15.933
8	.552	.664	.745
9	.856	.958	1.082
10	1.457	1.719	2.023
11	2.074	2.526	2.964
12	1.527	2.094	2.545
13	2.235	2.779	3.347
14	.091	.087	.099
15	.422	.328	.363
16	2.889	3.420	3.891
17	1.688	2.183	2.547
18	1.712	1.921	2.272
19	2.425	2.715	3.041
20	3.062	3.463	3.833
State Total	46.844	55.661	63.942

Source: Data prepared by State of Pennsylvania

Table 14-- - Historical and projected livestock water use by subregion

State and Subregion	1969	Projections			
		Series C		Series E	
		1980	2000	1980	2000
	MGD				
1	1.394	1.432	1.787	1.364	1.533
2	1.338	1.258	1.313	1.194	1.127
3	4.448	4.310	4.986	4.069	4.274
4	4.897	4.937	6.122	4.690	5.248
5	1.304	1.394	1.564	1.310	1.342
6	1.955	1.963	3.637	2.568	3.122
7	13.855	17.731	24.465	16.479	20.973
8	0.770	1.023	1.327	0.953	1.139
9	1.418	1.651	2.196	1.569	1.882
10	1.398	1.789	2.362	1.677	2.024
11	1.803	2.129	2.969	2.021	2.545
12	1.946	2.731	3.704	2.554	3.181
13	2.807	3.642	5.084	3.390	4.371
14	0.037	0.041	0.057	0.040	0.049
15	0.642	0.662	0.898	0.631	0.771
16	2.529	2.528	3.002	2.407	2.573
17	1.490	1.490	1.838	1.419	1.574
18	1.901	2.083	2.531	1.960	2.169
19	2.281	2.158	2.518	2.054	2.151
20	2.989	2.540	2.481	2.418	2.119
State Total	51.199	57.492	74.841	54.766	64.164

Source: Data prepared by ERS

CHAPTER VII. LAND USE

Midway through the study it became evident that the planned procedure for developing estimates of current land use was not viable. At that point study participants agreed that the only recourse was to update the 1967 Conservation Needs Inventory (CNI) to 1974. This chapter summarizes that work and discusses the projection of all major land uses for which the Economic Research Service was responsible.

Current Land Use[1/]

The 1967 CNI for Pennsylvania was chosen as the most useful source of data for consistent land use estimates available, given timing and funding constraints of the study. It was, however, considered to be out of date in view of substantial changes believed to have occurred in agricultural and urban uses of land. Therefore, a simplified procedure for updating the data to 1974 was devised which relied heavily upon the Soil Conservation Service District Conservationists' knowledge of their surroundings and the prodigious capacity of computers to handle masses of data efficiently.

To aid in the updating, a series of computer programs were written to print-out the 1967 published county totals on field survey forms. These forms, including inventoried as well as non-inventoried land for each county, were distributed to each District Conservationist with

---

1/ This section is based upon Waldon T. Miller "Current Land Use and Land Treatment: Pennsylvania (Revised 1974 Acreages)", Working Materials Prepared for Use by Cooperating Agencies, NRED, ERS, East Lansing, Michigan, November 1975.

instructions on how to complete the form with revised 1974 estimates. Using total land area, Federal non-cropland, urban and built-up, and small water areas as a starting place, estimates of additional large water area created since 1967 were subtracted to establish a new total land area for 1974.

The change in Federal non-cropland, urban and built-up, and small water area was estimated and added to (or subtracted from) the 1967 data to provide 1974 estimates. The sum of the 1974 estimates of these items resulted in the 1974 non-inventoried land total.

Total land area in 1974 minus 1974 non-inventoried totals became the estimate of the 1974 Inventory total. Changes in the inventoried acres and changes in major agricultural land use were distributed across cropland, pasture, forest, and other land to estimate the 1974 major land uses. The total of all major agricultural land uses had to equal the inventoried land acres. At this point county data were aggregated to the subregion level and became the basis for all projected land use (Table 15).

Projected Land Use

In the process of developing new estimates for 1974 land use the 1967 data were adjusted primarily to reflect changes that had occurred to the entire land base which would affect the availability of land for agricultural and forestry pursuits. Consequently, the only non-agricultural use of land allowed to change in the future was urban and related land uses. Therefore, the land use projections represent an estimated future condition without additional water resources development.

Table 15--- 1974 land use distribution by subregion

State and Subregion	Total Area	Federal non-crop	Urban built-up	Water area	Cropland	Pasture	Forest land	Other
	------------acres------------							
1	1,150,883	17,500	87,170	17,959	148,583	71,699	740,573	67,398
2	1,234,323	4,000	299,717	7,539	261,069	20,602	568,044	73,352
3	1,714,864	6,620	523,572	50,501	408,312	116,913	482,100	126,846
4	2,086,404	13,432	78,997	6,816	490,592	247,611	1,117,150	131,807
5	1,111,626	100	146,980	8,046	222,773	36,123	628,893	68,712
6	912,774	200	57,830	11,788	241,222	25,727	531,302	44,705
7	2,620,801	5,400	229,284	22,209	1,163,544	187,213	838,776	174,375
8	1,654,198	4,600	48,823	6,930	82,526	16,170	1,438,773	56,376
9	1,617,555	8,020	34,696	5,390	147,174	34,517	1,363,798	23,960
10	1,146,125	5,700	63,164	9,773	210,137	39,692	762,101	55,558
11	1,233,381	300	72,170	2,629	223,205	52,512	840,383	42,182
12	933,982	100	28,860	4,274	205,785	39,190	618,179	37,594
13	993,568	16,900	56,928	4,323	251,980	74,469	542,993	45,975
14	63,199	0	725	210	10,409	2,398	48,982	475
15	327,333	0	35,050	1,440	95,024	18,482	119,087	58,249
16	2,850,345	364,322	106,926	3,952	373,169	136,217	1,759,691	106,068
17	1,848,093	129,875	110,448	770	260,734	58,684	1,206,008	81,574
18	1,550,143	14,810	183,921	3,989	297,962	70,096	814,944	164,422
19	1,739,519	1,891	246,747	1,822	295,539	147,030	835,583	210,907
20	1,934,084	12,245	340,322	18,419	433,622	195,238	726,054	208,184
State Total	28,723,200	606,015	2,752,330	188,779	5,823,360	1,590,582	15,983,414	1,778,720

Source: Data prepared by ERS

Urban Land

Since increases in urban land use have gone on uninterrupted in this country since the beginning of settlement by the Europeans, it is evident that it will continue as population expands. Only the rate of change seems to fluctuate with time. In the early beginnings of this country those families moving to town required sufficient land to feed themselves and their animals. Later, with the shift to mechanical transportation and improved marketing facilities, urban land requirements became much less on a per capita basis.

Although the shift to high-rise apartment and condominium living is very land efficient, there has been a decided shift in desire for urban oriented open space. Often this takes the form of cluster development and associated park or recreational areas. There has also been a recent movement of people from city to suburban living which tends to offset gains derived from concentrated housing. Consequently, the downward trend in per capita land use has slowed considerably.

Since 1950, the urban use of land has increased between 20 and 30 acres for each additional 100 people in the country.1/ The east and west coasts were on the low end of the range while the southwest was at the high end. Assuming that the urban use of Pennsylvania land will conform closely to that indicated by recent experience in the Eastern United States, the rate of 21 acres per 100 additional inhabitants is chosen for projection purposes.

1/ Orville Krause and Dwight Hair, "Trends in Land Use and Competition for Land to Produce Food and Fiber," in Perspectives on Prime Land, USDA, 1975.

This rate was initially applied to the change in total population (Table 2) and used as control totals against which subregional urban land needs were checked. At no time was the sum of subregional urban land needs allowed to exceed the state control figure. Also, an additional control was imposed, principally in those subregions that were highly urbanized: all land uses could not exceed the available land base. This control necessitated slight adjustments in cropland and urban land in a few cases.

Total state urban land use is expected to increase by about sixty percent from 1974 to 2020, under the Series C level of population growth (Table 16). Subregion 14 will experience only a slight change in urban land needs, while all other subregions except 5 show a continuation of strong upward trends. Subregion 5 urban land uses were stabilized at the 1980 level because of a projected decline in population.

Cropland

The future availability and use of cropland was projected in two independent ways and checked with a third method. In the procedure described under projection methodology state level future agricultural production was converted through a system of projected average yields to acreages of each major crop. These, plus the average of miscellaneous crops not included in the projections, served as an absolute floor under future cropland acreage.

With a lower limit established in this manner the historic relationship of cropland to total land in farms was established. These trends were projected both at the state and subregional level and applied to OBERS estimates of future land in farms. An additional estimate was

Table 16---- - Current and projected urban land use by subregion[1/]

State and Subregion	1974	1980	1990	2000	2020
	------------------------------	------------------------------	acres	------------------------------	------------------------------
1	87,170	91,000	96,000	102,000	115,000
2	299,717	329,000	376,000	424,000	538,000
3	523,572	588,000	696,000	802,000	1,059,000
4	78,997	81,000	85,000	88,000	97,000
5	146,980	147,000	147,000	147,000	147,000
6	57,830	61,000	66,000	70,000	82,000
7	229,284	260,000	310,000	360,000	483,000
8	48,823	50,000	52,000	53,000	56,000
9	34,696	38,000	42,000	47,000	58,000
10	63,164	65,000	69,000	72,000	80,000
11	72,170	74,000	76,000	79,000	83,000
12	28,860	30,000	32,000	34,000	37,000
13	56,928	60,000	65,000	70,000	83,000
14	725	1,000	1,000	1,000	1,000
15	35,050	38,000	43,000	48,000	60,000
16	106,926	113,000	121,000	129,000	149,000
17	110,448	112,000	115,000	118,000	123,000
18	183,921	199,000	219,000	239,000	287,000
19	246,747	258,000	272,000	286,000	321,000
20	340,322	363,000	392,000	421,000	492,000
State Total	2,752,330	2,959,000	3,274,000	3,588,000	4,353,000

Source: Data prepared by ERS

[1/] All projections are rounded to nearest 1,000 acres; totals may not add due to rounding.

created by projecting cropland independent of any other constraints. All three estimates were compared and minor inconsistencies resolved (Table 17).

Pasture

The procedure for establishing future pasture acreage was similar to that discussed above for cropland except that the process for placing a lower limit was more arbitrary. Since the OBERS projections are primarily for marketed crop and livestock products, there is no projection for pasture. Pasture is only useful as livestock feed and is very dependent upon livestock management practices. These practices have shown a marked trend toward the feeding of more concentrates and silages under confinement conditions which tends to reduce the reliance on pasture.

Counter to the trend of reduced reliance on pasture as a component of livestock feed rations is the projection for increased numbers of roughage consuming livestock. Consequently, estimates were made of the absolute minimum acreage of pasture necessary to accommodate projected livestock numbers under the above relationships. An increment was added to account for non-production oriented uses of pasture such as for feeding horses and ponies, and for other uses. This then served as the lower limit and was resolved against a projection of pasture acreage as a component of land in farms (Table 18).

Forest and Other Land

Forest land use projections were the responsibility of the Forest Service and were coordinated with the Economic Research Service land use projection effort. The other land category was treated as a residual representing the acreage remaining after all major land uses were subtracted from the total area.

Table 17-- Total Cropland, current and projected acreage by subregion[1/]

State and Subregion	1974	Projections 1980	1990	2000	2020
	acres				
1	148,583	130,000	119,000	111,000	99,000
2	261,069	225,000	191,000	165,000	129,000
3	408,312	385,000	333,000	292,000	235,000
4	490,592	439,000	413,000	393,000	364,000
5	222,773	193,000	178,000	166,000	150,000
6	241,222	218,000	202,000	190,000	174,000
7	1,163,544	1,064,000	1,016,000	976,000	920,000
8	82,526	73,000	53,000	40,000	23,000
9	147,174	139,000	120,000	105,000	84,000
10	210,137	184,000	173,000	164,000	151,000
11	223,205	196,000	177,000	163,000	143,000
12	205,785	186,000	174,000	165,000	152,000
13	251,980	251,000	231,000	211,000	184,000
14	10,409	9,000	8,000	8,000	8,000
15	95,024	82,000	76,000	72,000	67,000
16	373,169	301,000	266,000	243,000	212,000
17	260,734	213,000	180,000	153,000	117,000
18	297,962	241,000	211,000	187,000	154,000
19	295,539	260,000	219,000	187,000	142,000
20	433,622	362,000	316,000	280,000	229,000
State Total	5,823,360	5,149,000	4,657,000	4,272,000	3,737,000

Source: Data prepared by ERS

[1/] All projections are rounded to nearest 1,000 acres; totals may not add due to rounding.

Table 18-- Pasture, current and projected acreage by subregion [1/]

State and Subregion	1974	Projections 1980	1990	2000	2020
		acres			
1	71,699	65,000	50,000	44,000	37,000
2	20,602	17,000	11,000	7,000	4,000
3	116,913	112,000	93,000	85,000	74,000
4	247,611	227,000	185,000	162,000	135,000
5	36,123	32,000	24,000	20,000	15,000
6	25,727	26,000	23,000	20,000	17,000
7	187,213	185,000	176,000	162,000	147,000
8	16,170	16,000	11,000	8,000	4,000
9	34,517	32,000	28,000	22,000	14,000
10	39,692	35,000	30,000	27,000	23,000
11	52,512	52,000	48,000	43,000	37,000
12	39,190	38,000	38,000	35,000	31,000
13	74,469	73,000	70,000	65,000	59,000
14	2,398	2,000	2,000	2,000	1,000
15	18,482	17,000	12,000	9,000	5,000
16	136,217	118,000	89,000	76,000	60,000
17	58,684	56,000	47,000	40,000	33,000
18	70,096	67,000	57,000	50,000	41,000
19	147,030	146,000	127,000	109,000	89,000
20	195,238	185,000	157,000	141,000	123,000
State Total	1,590,582	1,501,000	1,277,000	1,124,000	950,000

Source: Data prepared by ERS

[1/] All projections are rounded to nearest 1,000 acres; totals may not add due to rounding.

APPENDIX A

HISTORICAL SETTING BY SUBREGION

Subregion 1

Subregion 1, located in the Pocono mountains, was first settled by a group from Connecticut in 1754. Their settlement was based on Connecticut claims resting on boundary lines drawn on the Connecticut Charter of 1662. This Charter gave the colony a boundary running West from sea to sea, excepting only territory not held by another colony. Thus, New York was excluded, but to the west of the southeastern tip of Connecticut the westward line cut across northern Pennsylvania. To effect this claim the Delaware Company, organized in 1754, began the first permanent settlement in the Cushetunk region of the upper Delaware River in present Wayne County. The Penns disputed the claim, and, consequently, there were many skirmishes known as the Yankee-Pennamite wars. It was not until after 1800 that all the local legal disputes over land titles were solved. Connecticut's claim was not recognized, but the settlers were allowed to remain - imparting some New England character to Northeastern Pennsylvania.

In the early 1800's immigrants came to the state in great numbers, but most came to the neighboring valleys and to the mining regions where employment was readily available. There was no influx of population in the Pocono mountain region at this time. The mountains were not high rugged peaks that were barriers to settlement but high forested hills, scattered with lakes. Nevertheless, the farming was poor and there were no minerals to mine. Consequently, the area had no attraction for immigrants that were principally farmers or laborers. Finally, migration to the subregion was not difficult as access to the area was provided by the Delaware River. In other subregions the rivers were the principal highways for commerce; however, since there were no local products to ship to Philadelphia, the river was not used for commerce and remained scenic and unspoiled.

About 1820, when a frenzy of canal construction was going on throughout the state, a canal was extended into this subregion. The Delaware and Hudson Canal, by 1828, had connected the Wyoming coal fields around Carbondale with the Delaware and Hudson rivers, which provided a direct outlet for Pennsylvania anthracite to New York City. A gravity railroad from Honesdale over Moosic Mountain to Carbondale formed part of the system. Eventually canals gave way to the railroads as railroads could be built just about anywhere, they did not freeze, and they ran on schedule. The first steam locomotive to run on rails in the United States was the "Stroudsburg Lion" imported from England and used on a trial run. On August 8, 1829 it steamed over the fifteen-mile stretch from Honesdale to Carbondale and then returned. Although a first - the rails were too light and the mountainous terrain difficult so the achievment was not continued.

The Pocono region was left unchanged; it's mountains, forests and lakes unspoiled. With the development of an advanced highway network the subregion has become a resort area with no urban center - a refuge for persons seeking temporary escape from urban living. Stroudsburg is the largest town and community center but it is not urban in any sense of the word. In the past there were problems with the seasonal economy that is characteristic in recreational areas; however, this problem has been mitigated by the skiing boom that has enabled the area to become a winter resort as well as a summer playground.

A difficult problem for the future is to meet the growing demand for recreation homes and seasonal water supply emanating from the Philadelphia - New York City megalopolis - without destroying the scenic, tranquil aspects of the area that is its primary attraction.

Subregion 2

Most of Subregion 2 is located in the Lehigh valley; however, the subregion boundary includes portions of two distinct areas - the anthracite and mountain regions. The Lehigh valley is twelve to eighteen miles wide and is part of a "great valley" that extends from the St. Lawrence to central Alabama. Northwest of the Lehigh valley lies a high shale bench that is the boundary to the anthracite region. Blue mountain, a prominent ridge, is a physical barrier between the northern anthracite area and the southern valley. The southeast boundary of the Lehigh valley is a series of forestland hills that range to the Delaware River.

Agriculture was the economic base of the first settlements but was supplemented by the manufacture of iron products. Iron was forged into tools and implements necessary for farming and settlement. Small forges and furnances were erected by the settlers not long after they constructed their gristmills and sawmills. Iron ore was abundant, the forest furnished charcoal for fuel, and the streams supplied water power. One of the first iron works, the Durham furnace, was established in Bucks County in 1728 and was an important stimulus for area development.

Early settlement took place in Lehigh valley as the Delaware and Lehigh Rivers provided ready access to the area. The first settlers were German and Swiss immigrants, a trickle at first -- became a torrent as Mennonites, Lutherans, Reformed German Baptists, Moravians, Schwenkfelders, and others came seeking religious freedom and opportunity. These immigrants were farmers, and they found the limestone soil in the valley ideal for farming and the area conditions similar to what they had been accustomed to in Europe.

The Moravians established one of the first permanent settlement in 1740. Devoted to Christianity they founded a religious community on the banks of the Lehigh River. The place was named Bethlehem by Count Zeinzendorf (their sponsor), because he spend Christmas Eve in a two-room cabin listening to the cattle in the adjoining room.

Communication and transportation were difficult, and early inhabitants had to rely on the river and indian trails. Roads to the interior were being constructed, but they were rough and difficult for travel. The rivers were the highways as rafts and dugouts were used to transport farm goods to the market in Philadelphia. The first advance in transportation on the Delaware River was the Durham boat. First constructed in 1750, these boats were named for the Durham iron furnance near Easton. These vessels, usually 60 feet long, eight feet wide and two feet deep, could carry fifteen tons of freight, drawing twenty inches of water. They brought iron, lumber and agricultural products down the river. The boats, which had a mast and two sails, were manned by a crew of five men, one of whom was the steersman while the other four pushed the craft forward with poles. In that way the boats travelled both up and down stream.

Pennsylvania coal was first discovered in 1762, and by 1803 two arkloads of Lehigh anthracite were shipped down the Lehigh and Delaware Rivers to Philadelphia. However, coal did not come into general use until later. The development of the anthracite industry began in 1820 with the Lehigh Coal and

Navigation Company, which represented a merger of coal mining and transportation interests. The Company built a series of canals extending 84 miles down the Lehigh River from Stoddardville to Easton, where the Lehigh and Delaware Rivers intersect. In conjunction with the canal, the Mauch Chunk Railroad was built in 1827 to connect the coal mine of the Lehigh Coal and Navigation Company with the Lehigh River, a distance of nine miles. This was a coal road as the cars descended by gravity and then were drawn up by mules. Large scale operating railroads did eventually develop when the Lehigh Valley Railroad opened in 1855 and paralleled the canal and river, its tracks running from Easton to Mauch Chunk.

In additional to coal, another product made a significant impact on the area's economy - Portland cement. At the village of Coplay near Allentown, David Saylor successfully experimented with local rock which led to commercial production of Portland cement; thus, the center of this industry was located in the Lehigh valley. Portland cement came at a time when industrial expansion and urban growth were making demands for new building construction. Cement and steel combined to produce a revolution in industrial and commercial building.

The three largest cities in the subregion - Allentown, Bethlehem and Easton - benefited from the canal and railroad as they were the junctures between the anthracite region and Philadelphia. Allentown, the largest city in the subregion, is on the edge of the Philadelphia metropolitan region; Bethlehem, next in size, is the company headquarters of the Bethlehem Steel Works; and Easton, the smallest of the three cities, is located at the juncture of the Lehigh and Delaware Rivers, across from New Jersey.

Although the economy of the area was closely tied to mining, the subsequent automation of that industry did not result in the area becoming economically depressed. The influence of the Philadelphia and New York metropolitan area has spread into the subregion, and growth has occured. The area has a good interstate highway system and enough diversified manufacturing to sustain future growth. There are some limitations to develop in the Blue mountain area, but increasing demand for recreation has begun to stimulate that area's economy. It is anticipated that further growth will occur within the subregion; however, the challenge will be to combine future growth with a system for orderly development.

Subregion 3

Although the real history of Subregion 3 begins with the founding of the Quaker commonwealth by William Penn, its preliminaries are found in the earlier explorations and settlements along the Delaware River. As the rivers formed natural highways for early settlers, it was prudent that forts and towns were located on river banks.

The Dutch were the first explorers of this region in 1616, but the Swedish came in 1638 to farm and settle the Chester area. These first settlements provided a foothold in the New World so that when William Penn arrived in 1682 there were approximately 1,000 settlers in the region. These settlers had begun shipbuilding, barrel making and established a grist mill powered by the waters of Cobbs Creek.

Penn established his settlement of Philadelphia at the junction of the Schuylkill and Delaware River. This location proved to be most advantageous as the Schuylkill River provided access to the rich farmland in the interior, and the Delaware River provided a deep water port so that Philadelphia became a major shipping center. Within a generation after the coming of William Penn, the characteristics of a frontier community had vanished throughout the region. Philadelphia developed a thriving trade and many businessmen grew rich from foreign commerce. Shipbuilding and manufacturing flourished so that the Quaker city became a prosperious community and a cultural center. The rural districts with abundant ore and rich fertile farmland also became thriving communities. The first rolling mill in the Nation was founded in Chester County by Isaac Pennoch in 1793.[1/] Now known as the Lukens Steel Company it continues to be of economic importance to this area. Chester County also became the mushroom capital of the United States. In 1885, two florists living in Chester County William Swayne and Harry Hicks, began to grow mushrooms to sell. The area now has more than 600 growers that annually produce approximately 80 million pounds of mushrooms.[2/]

Manufacturing began in the weaving shops in Philadelphia following the Revolution. Water powered the mills and cheap labor was readily available in the city. During this period water power stimulated industrial growth; in addition, iron production was expanded to meet the needs of a growing post-revolution population. Water power, however, soon gave way to steam power, and more and more factories sprang up in and around Philadelphia. Steam pumps were used as early as 1799 to raise water from the Schuylkill River to a reservoir to provide portions of Philadelphia with one of the nation's first water supply systems. The opening of the Fairmont Waterworks in 1822 supplied water to the entire city of Philadelphia.[3/]

[1/] Chester County Commissioners, History and Progress of Chester County, p. 49.
[2/] Ibid, p. 29-30.
[3/] Wayland F. Dunaway, History of Pennsylvania, 3rd ed., (Englewood Cliffs, NJ), 1958, p. 59a.

The city was growing as a population and manufacturing center, but transportation was a problem. This problem was resolved by the construction of a number of canals during this period. The most important was the Schuylkill canal. Opened in 1825, the canal went from Pottsville to Philadelphia and was built to haul coal from the Anthracite region to Philadelphia. Approximately 1,600,000 tons of anthracite was hauled down the canal by 1860. The city of Reading evolved as a major transportation center because it was located at the juncture of the Union and Schuylkill canals. This was an important terminal because the union canal was the link from the Susquehanna to the Schuylkill River. Agricultural goods were shipped down the Susquehanna to Philadelphia via Reading. The Schuylkill canal provided a reasonable means of transporting these goods to their market in Philadelphia. Canals were being built in rapid number as the overall goal was "navigable communications between the eastern and western waters of the State and Lake Erie."[4/] The building of canals was stimulated by competition for western trade. It was recognized on all sides that the trade of the developing west was a prize well worth competing for, and that it would be captured by the Atlantic port which offered the quickest and cheapest transportation to the seaboard. Philadelphia was threatened with the loss of this trade to New York, since the Erie Canal gave that city an all water connection with the West. Furthermore, Baltimore was fast becoming a serious commercial rival of Philadelphia, not only because the natural outlet of the Susquehanna valley region was down the river to Baltimore, but also because the latter city was 90 miles nearer to Pittsburgh and the Ohio River than Philadelphia, and had cheaper freight rates to and from the west.

4/ Ibid, p. 594.

In colonial times and up to 1800, Philadelphia was the capitol of the nation, the capitol of the state, and the economic leader in the colonies. By 1825 all this had changed. The Nation's capitol was moved to Washington, D.C.; the state capitol was moved to Lancaster and finally to Harrisburg; and New York City was becoming the economic center of the Nation.

The products of southern, southeastern and central Pennsylvania found a market chiefly in Philadelphia, whence the surplus was either distributed to Atlantic ports or shipped abroad. However, the importance of natural resources to this region steadily declined after the Civil War, due to the rapid expansion of rail transportation; the rapid growth of industrialization; and the overall development of the abundant resources of the west. A notable exception was the mining of anthracite which continued in the northern corner of the subbasin until World War II. During the first World War annual production of anthracite was 100 million tons and by 1930 one tenth of the world's anthracite production came from the Scranton Area.5/ Anthracite was used primarily to heat homes. Coal was cheap and burned efficiently, however, it was not convenient and fuel oil and natural gas replaced its use in the home. Anthracite is still plentiful but lacks a market. Although Philadelphia lost its primary position, the city and its region was still major manufacturing, trade and population center.

There was general prosperity after the Civil War which resulted in expansion of railroads, banks, and manufacturing. This came to an abrupt end with the panic of 1873 which brought depression, hard times and wide unemployment.

5/ Pennsylvania's Regions, A Survey of the Commonwealth, Pennsylvania State Planning Board, p. 51.

Between 1840 and 1890 population was increasing rapidly and immigration was a substantial factor. There were 731,505 foreign born persons in the State by 1890.[6/] Immigrants were attracted to the urban region where jobs were available. In the city of Philadelphia alone, the population increased from 100,000 in 1840 to 675,000 in 1870. Although the state wide population increased from approximately 1,700,000 in 1840 to 5,250,000 in 1890, the area surrounding the city of Philadelphia was and continues to be the most densely settled region in the state.

Most of the water used in the Philadelphia area was drawn from the Schuylkill and Delaware rivers. The Schuylkill River was once a dark mass filled with coal washings and untreated sewage; it has since improved. Although the Delaware River has a serious pollution problem, the threat to the water supply is the corrosion that would result from salt water intrusion.

This region became a center of population trade and manufacturing principally because water was available for consumption, for transportation, and for power. The problem that exists for the future will depend upon how well this region can harmonize its needs with the water resources available.

Subregion 4

Subregion 4 is in the northeastern portion of the state of Pennsylvania with the northern boundary of the subregion located along the New York-

---

[6/] Wayland F. Dunaway, History of Pennsylvania, 3rd ed., (Englewood Cliffs, N.J.), 1958, p. 528.

Pennsylvania state line. Early settlers came to this region from New England in the late 1700's. In 1753, an association known as the Susquehanna Company was formed in Connecticut for the settlement of the Wyoming territory. Over six hundred Connecticut people, and fifty others from Rhode Island, Massachusetts, New York, and Pennsylvania, invested in the stock of the syndicate, though it was essentially a Connecticut enterprise. Connecticut's claim to the territory was based on the Royal Charter of 1662, which defined the colony's western boundary as extending to the Pacific Ocean but excepting any territory "then possessed by other Christian prince or state." New York was inhabited and, thus, its boundary was not in dispute.

In 1782, after many years of bickering and a few skirmishes, Congress settled the boundary dispute in favor of Pennsylvania. The result of the whole controversy was the introduction into Pennsylvania of a large number of New Englanders, who settled on both sides of the Susquehanna from Wilkes-Barre to the New York line.

Lying within the subarea is the north branch of the Susquehanna River which twists and turns from New York state south to Chesapeake Bay. The river played an important role in the development of the subregion. Early settlements were located along the river bacause water was necessary to power the grist and saw mills. Grist mills produced flour and saw mills provided the raw lumber for shelter and tools. The river also served as a highway, transporting goods and people, since the overland routes were long, hazardous and costly. Pack horse trains carried goods to market, but the load limit for each horse was about 180 pounds; generally there were fifteen horses to a train. On the river, huge arks, ninety feet long, sixteen feet wide, and four feet deep, could carry sixty tons of cargo to Baltimore. One out of three never reached Baltimore because the Susquehanna is shallow, rocky, and has treacherous rapids. Most trips were made in the Spring, in June, and in the Fall when the river was deep and the current was flowing; also at this time the river was most dangerous. Once the arks arrived at their destination they were dismantled and the lumber was sold for an additional profit.

Transportation difficulties were alleviated by the construction of the North Branch Canal along the Susquehanna from Wilkes-Barre to Sayre. The canal was completed in 1855, but it never functioned properly as leaks and repairs hampered its use. In 1859, it was sold under the condition that a railroad would be build along the right of way. Within nine years a railroad was built from Wilkes-Barre to the New York state line.

Elsewhere, most canals were built from 1820 to 1830 and railroads were constructed in the 1850's. Thus, the late construction of these transportation systems in this area created a serious economic disadvantage. Regional trading centers evolved from market towns and distribution points along the canals and railroads; however, because of the time lag, this process did not occur in the subregion. Nevertheless, there are trading centers nearby - Elmira, Binghamton, and Corning in New York state; Scranton, Wilkes-Barre, and Williamsport in Pennsylvania.

In the past, dairy farms have been the major agricultural pursuit and a principal source of employment. The hilly wooded terrain, a short growing season, and the soil conditions allow for an abundance of pasture and hay and not for general farming. There are local industries throughout the subregion, but the area is predominately rural. Along the northern portion of the subarea, there is some employment in the lumber industry and this is expected to increase as pasture and cropland is converted to forestland.

Subregion 5

The Lackawanna and Wyoming valleys are within Subregion 5. This area is located in the heart of the anthracite region, through which the north branch of the Susquehanna winds in a southwesterly direction. Major towns and cities are situated along or near the river, as it was the main artery for communication and trade. It was also the source of power for the grist and saw mills which provided flour and building materials.

About the middle of the eighteenth century, white settlers came and lived amicably with the Indians for a time. Many of these settlers were from Connecticut, as Wilkes-Barre and the surrounding region was a strategic point in the long conflict between Pennsylvania and Connecticut over the Wyoming lands. As early as 1755, the Susquehanna Company from Connecticut tried to colonize the region although the Penns claimed ownership under the Royal Deed of 1681. The Connecticut settlers built Fort Durkee and laid out Wilkes-Barre and, in 1771, the Connecticut people controlled the valley.

However, seven years later the Indians and Tories swept through the valley leaving the town of Wilkes-Barre in smoldering ruins. The "Wyoming Massacre" at Forty Fort, in 1778, spread panic throughout the region, and the valley was depopulated by white settlers; it remained virtually uninhabited until 1788. Then Philip Abbott, who had migrated from Connecticut to the Wyoming valley before the Revolution, came to the area and built a log hut and grist mill beside Roaring Brook. Eventually other settlers followed.

There followed, in 1785-6, a period of confusion in which Pennsylvania governed a region peopled by settlers loyal in the main to Connecticut. The controversy was brought to the new Congress, and it decided in favor of Pennsylvania's claim to the Wyoming valley; Connecticut formally released its claims to the area by 1800.

Meanwhile, the County of Luzerne was created and, in 1806, Wilkes-Barre was incorporated as a Borough. A few years later, veins of hard coal discovered in the early 1760's, were recognized as the source of great potential wealth - and the anthracite industry in the Wyoming valley was born. By 1812, Wilkes-Barre had grown from a handful of people to a small town, but it was many years before it changed from a farming to an industrial center. Development of canals and railroads in the second quarter of the century, in addition to the growing demand for hard coal as domestic fuel, gave impetus to the anthracite industry.

Scranton, capital of the anthracite basin, lies in the narrow, crescent-shaped Lackawanna valley. Mountains hem in the city - to the north and east the Moosic mountain, to the west the West mountain. Larger than Wilkes-Barre, Scranton's development was similar.

In 1840, two brothers, George and Selden Scranton, attracted by the abundance of iron ore and anthracite, organized the firm of Scranton, Grant and Company and built a forge. This firm was the nucleus of the Lackawanna Iron and Steel Company, which developed when the Scrantons successfully manufactured iron with anthracite as a fuel. The Scrantons called the settlement Harrison, in honor of President Harrison, but the post office was Scrantonia. Eventually the town and the post office were called Scranton.

Iron was shipped either to Philadelphia down the Lackawanna and Susquehanna rivers to the Union Canal or right down the Susquehanna to Baltimore. The trips down the river were long, dangerous and expensive. Often, the rafts and arks were broken up in the rapids, and the trips could only be made when the river was at flood stage. The river was most dangerous at this time and everyone's cargo arrived at the market place simultaneously, which drove the prices down. However, in 1853, the first locomotive of the Delaware and Lackawanna Railroad came to the area, which greatly expanded the market for the iron industry. Shipments could be made safely, steadily and cheaply.

Development of the coal mines in this subregion attracted thousands of immigrants. Until 1870, all immigration was from northern Europe and the British Isles, with the Irish predominating. Then, mine operators sent representatives to central and southern Europe to induce peasants to come to the coal fields. They came and the population thereafter increased rapidly.

During the latter decades of the nineteenth century, a number of large manufacturing plants were drawn to the area by cheap coal and extensive railroad facilities were established. These plants manufactured everything from miner's caps to small locomotives and cables. The supply of female labor and available water power attracted textile mills; the first lace manufactured in the United States was made in this area in 1885. Scranton and Wilkes-Barre became lace manufacturing centers.

Although there was diversified manufacturing, the most significant economic activity depended upon coal. By 1917, the anthracite industry reached its peak; however, by 1922, it had dropped one-half in production and continued a general decline. Because it was cleaner than soft coal, anthracite had been the fuel used for domestic heat, but, once developed, fuel oil and natural gas became more convenient for the home owner and the market for anthracite was lost.

The decline of the anthracite industry caused hardship and unemployment for many in the area. Also, years of careless mining had left blackened hills, scarred mountains, and unsightly coal refuse piles. There since has been a strong local movement to attract new industry and improve the environment in this region. With much community and State effort, new jobs have been created and the region has exhibited some growth.

Subregion 6

The Susquehanna River flows north-south through the heart of Subregion 6. A few miles north of Harrisburg the Juniata River flows from the west to the Susquehanna. These two rivers have greatly influenced the development of the subregion principally as routes into the interior. Travel over the mountains and ridges was difficult for the pioneers, but the rivers cut across the parallel northeast-southwest ridges and valleys and provided the major historic north-south and east-west travel routes.

These natural routes were used first by the Indians. A major path to the interior was the Susquehanna Trail which led northward along the river, connecting with the Shamokin trail at what is now Sunbury. This latter trail followed the Susquehanna's west branch to what is now Port Allegheny, where it struck the Kittanning path, extending from the Allegheny River to the Juniata. Subsequently, the Juniata trail followed that river eastward back to the Susquehanna.

Before the Revolution, settlers used these trails to penetrate the region. Numerous settlements were located in the Juniata Valley, the upper Susquehanna beyond Harris Ferry and into the trans-Allegheny region. By 1772, Northumberland County was created to govern the Juniata and Susquehanna settlements. The town of Sunbury also was laid out in that year.

Early settlers were engaged primarily in farming, transportation, and mining in that chronological order. These activities depended upon the rivers, as they were vital carriers of both people and goods and, thus, shaped the course of settlement. The rivers were even more important as a source of power in the days when water wheels turned the machinery of the saw and gristmills and even for generating the blast of the furnaces that made iron.

The earliest farms were established in the wide fertile river valleys drained by the Susquehanna. This was the location of the first settlements because farming was the only available livelihood. The Scotch-Irish were the original settlers of the subregion, but the Germans that followed them came in greater numbers. The Pennsylvania German pioneers found rural life congenial. None contributed so much as they to the agricultural development of the area, and they were unquestionably the best farmers in the colony. While most were farmers, many were also millers, weavers, carpenters, wheelwrights, traders, and some excelled in manufacture of iron, glass, and pottery.

As the subregion developed, the variation and diversity that existed in the area became more apparent. It would be difficult to find anywhere a sharper difference in the characteristics of adjacent areas. Sunbury, located in the north central part of the subregion, is at the confluence of the Susquehanna's west and north branches. An easterly route from Sunbury courses through the heart of the lower anthracite region. Shamokin, Mount Carmel, and

Shenandoah are coal towns, and in varying degrees suffer the economic plight of unemployment and recession common to the anthracite region. A high unemployment rate and the lack of economic growth have come about because the demand for coal was reduced and automation in the mines increased. Along the Susquehanna as it flows to the southern portion of the subregion are a series of towns, Selinsgrove, Port Traverton, McKee Half Falls, and Millersburg, that were distribution and trading centers for farmers. In a southwesterly direction from the river lie small Pennsylvania German towns which follow the irregular course of valleys walled in by heavily timbered slopes of the Allegheny Mountains. Northwest of the Susquehanna there are fertile valleys that lie within rolling mountains.

On the Susquehanna, the main traffic was by means of rafts and arks, the former for lumber and the latter for produce. The rafts were made of logs and were usually one hundred and fifty to three hundred feet long. The crew consisted of two men, and usually two rafts went downstream together. Steamboat navigation was established by 1812, but the Susquehanna and the Juniata were too shallow and had too many falls to accommodate the steamboat. However, by 1827, a canal was constructed that connected the Susquehanna and the Schuylkill. The canals and, later, the railroads helped to create new communities and opened up new markets for the region's abundant resources.

Soon after the subregion was settled, iron mining began on a small scale. All of the early forges used water power, producing charcoal iron. Coal, which revolutionized the iron industry in other parts of Pennsylvania, came into use on the eve of the Civil War and was abundant in the subregion. Another industry, the manufacture of textiles, developed in the region as an outgrowth of the available water power and resources. Hemp, flax, and wool were produced on the farms and furnished raw materials in abundance. The cultivation of hemp and flax was noted among the German and Scotch-Irish settlers. The textile industry gave employment to dyers, cardmakers, combmakers, spinners, and weavers. Although in recent years this industry has declined, there are still textile mills within the subregion.

Geography and natural resources have contributed to the settlement and development of Subregion 6 . Although some areas have suffered and declined with the loss of jobs in mining and textiles, other areas of the subregion have grown and continue to grow. Nevertheless, the communities that have declined have adequate programs that will improve living standards for residents and attract new industry.

Subregion 7

The main stem of the Susquehanna River runs through Subregion 7. An area that encompasses the Lancaster and York valleys; the Cumberland and Lebanon valleys; a portion of the Gettysburg plain; and the ridge country of Perry and Dauphin Counties. The major urban centers are Harrisburg, Lancaster and York. These regional centers are engaged in prosperous farming and have enough manufacturing so they are not economically dependent upon agriculture.

Adjacent to the Philadelphia area, settlement came to the subregion as a natural outgrowth from that city. The first county formed outside the three original counties of Philadelphia, Chester and Bucks was Lancaster, which was carved from Chester County in 1729. Population grew rapidly in this region; as a result the Penns laid out the town of Lancaster in 1730, and it soon became the great inland county of the colonial era. This was remarkable because, unlike most early towns in colonial America, it was not on a waterway but maintained contact with the sea and Philadelphia by overland travel. By another twenty years population had moved across the Susquehanna in large enough numbers to justify establishing York County (1749) and laying out the town of York (1741). A year after York County was created Cumberland County was formed as the Scotch-Irish pushed into the broad valley of the same name. This outward thrust of population from the lower Delaware followed an overland route long developed by the Indians for trade and communication to the northwest, the old Minqua path. The movement of early settlement was in this direction rather than up the valleys of the Delaware or the Schuylkill.

Early settlement occurred because the valleys in the subregion were rich in limestone and were ideally suited for farming. The first to settle and farm the subregions were members of persecuted sects that had emigrated from Germany for religious reasons. The most numerous of these groups were the Mennonites and Amish who were the pioneers in Lancaster County. A later mass immigration of Germans began in 1727 and continued until the Revolution. The second wave were predominately church people, as the Lutherans and the German Reformed were customarily designated to distinguish them from the sects that comprised the earlier immigration and worshipped in each others homes.

Like the Welsh and Scotch-Irish, the Pennsylvania Germans were clannish and from the beginning they sought (as far as circumstances allowed) to keep themselves apart from the other racial groups. Since most of them were Lutherans and German Reformed, their differences in religion and language tended still further to prevent their amalgamation with their neighbors on either side - the English on the east and the

Scotch-Irish on the west. Hence one finds the Pennsylvania Germans persisting as a separate unit in spite of the assimilating influences around them. Throughout the Pennsylvania German area the prevailing language was German, and in many communities it was the only language spoken.

The Germans were among the most successful farmers in the colony. In general they owned the best lands, worked their farms industriously, took great care of their livestock, and had excellent barns and fences; and it was they who developed the Conestoga horse and the Conestoga wagon. These wagons carried large quantities of flour to Philadelphia from the interior, especially from Lancaster. On the whole, Pennsylvania German land was the most productive agricultural region of colonial America.

Produce raised in the Susquehanna valley found a convenient market in Baltimore, which was easily accessible by transportation down the Susquehanna River and its tributaries; though some of the products were shipped by a mixed land - and - water carriage to Philadelphia.

Philadelphia's concern for better communication and increased trade with the interior resulted in granting a charter to the Lancaster Turnpike Company to build a revolutionary new turnpike highway between these two points. It was built in 1792-1794 - and was the first American road with a hard stone foundation. The new road quickly was thronged with stages and heavy freight wagons. It reduced the cost of overland freighting by two-thirds, and its success inspired a wave of turnpike building throughout the country.

Waterways are always cheaper than travel by wagon or stage. In 1811 the Union Canal Company was chartered to build a canal from Middletown on the Susquehanna below Harrisburg to Reading and the Schuylkill. It was completed in 1827. The state of Pennsylvania set out to build a system of canals, the main line of this system utilized the 82-mile long Columbia Railroad from Phildelphia to the canal proper at Columbia on the Susquehanna. Harrisburg and Columbia are the only cities in the subregion located on the water, and they became the transportation terminals for the subregion.

The rush to build turnpikes and canals gave way to the railroad. The competition between Philadelphia and Baltimore for trade in the rich Susquehanna valley resulted in the construction of a rail system with Harrisburg at the center. The railroads freighted large volumes of farm products and the farm economy in the subregion prospered.

Harrisburg is the State capital as well as the regional center. Strong racial and sectional antagonisms provoked a movement to change the location of the capital from Philadelphia. Lancaster served as the capital from 1799 to 1810; Harrisburg became the capital officially in 1812. The city is located on the banks of the Susquehanna River and at the point where the river traverses Blue mountain. Because of this location Harrisburg became a natural center for the railroads. The tracks followed the Susquehanna and Juniata Rivers to the interior while others branched out - southwest to Chambersburg and Hagerstown, south to York and Baltimore, east to Philadelphia and northeast to Lebanon, Reading and Allentown. Harrisburg remains a transportation center although the economy is diversified - a great deal of economic benefit is accrued from having both transportation and governmental facilities located in Harrisburg.

Lancaster is the center of the Pennsylvania Germans, often referred to as the Pennsylvania Dutch, which is an aberration of Deutsch - meaning German. The city has a growing economy with no serious unemployment problems.

Jobs are divided between manufacturing, agriculture, trade and services.

York is similar to Lancaster but has better transportation; a major interstate highway (83) connects it with Harrisburg and Baltimore. York has the same diversified economy with manufacturing, trade, agriculture and services providing substantial employment.

The water and land resources in this subregion have provided a foundation for continued economic growth. Prosperous farming communities also contain manufacturing plants that prevent dependency upon agriculture alone. The region centers are independent but are economically, physically and culturally similar.

Subregion 8

Much of Subregion 8 lies in the heart of the mountain system in the north central part of the state. Within the area there is a shifting panorama of valley, hill and stream. Occasional settlements are clustered where small creeks empty into the Sinnemahoning Creek and the West Branch of the Susquehanna River.

A century ago, logs moved along the waterways and these streams supplied power for the saw mills. When the Scotch-Irish and German pioneers began their inroads upon this area in 1784, the forests of pine and hemlock were already between two and three hundred years old. The first settlers had passed away before this timber was recognized as anything more than an obstacle to the business of clearing land and planting crops. Then, almost overnight, the axe began to fly in a thousand clearings, and saw mills sprang up along streams and the river - the highways of the lumber industry.

Lumbering on a large scale started prior to 1840, and towns along the Susquehanna were transformed into great lumbering centers. It is estimated that $250,000,000 worth of lumber was floated down the West Branch before timber in this area became depleted.

The earliest means of shipping logs was by raft. One of the first rafts down the West Branch, in 1844, was used in the Columbia-Wrightsville bridge. At the end of the trip it was customary to break up the raft and use the lumber because the raft could not return upstream. The raftsman made $17 for the trip and had to walk back. Raftsmen had their romantic legends and verse that were childish but vigorous. Their life, crude, violent, humorous, and hard, was the typical life of pioneers in a dozen American industries. Rafting diminished in importance after the middle of the 1850's with the construction of "booms" or river traps for free-floating logs. The free-floating logs created dangerous jams and interfered with safer manipulation of rafts, and for years relations between logger and raftsman were bad; mob fights were frequent.

The wealth in lumber rested on the abundance of white pine, as hemlock, at first considered valueless, was ruthlessly destroyed until pine forests were despoiled. However, valuable tanning properties were discovered in hemlock bark, and the tanning industry grew throughout the West Branch area.

The tanning business made an alliance, about 1890, with the lumber people. Pennsylvania tanneries needed hemlock bark to tan hides, and for some time standing hemlock trees were stripped of their bark. Eventually, it was realized that the trees themselves were a source of income as timber. The Central Pennsylvania Lumber Company, organized in the nineties, became the largest lumbering concern east of the Mississippi, cutting mainly hemlocks and taking the bark for tannery use and using the timber for lumber. Related wood-using industries sprang up close to the lumber area. Entire towns, such as Emporium, developed in northern Pennsylvania centering on lumbering.

In the southern portion of the subregion, bituminous (soft) coal mining dominated the economy as lumbering did in the north. Coal on rafts and barges was floated down Chest Creek to the steel mills in Johnstown. Increases in the output of soft coal were directly related to the expanding steel industry.

Although trading centers developed along the waterways to serve the needs of raftsmen and local industry, the southern portion of the subregion remained comparatively rural. This was due in part to the mining of soft coal. Bituminous coal is widely dispersed with thin seams. The coal is stripped from the earth and miners followed the coal seams. As a result, towns or even camps remained small and isolated.

A marked decrease in demand for soft coal over the past two decades had a significant impact on the regional economy. Technological advances in steel making significantly reduced the amount of coke required to melt the iron ore. Moreover, steel production declined in Johnstown and Pittsburgh because of shifting demand and supply patterns. Also, the railroad's conversion from steam to diesel engines left deep inroads in soft coal output.

The subregion suffered with the decline of its two major industries, lumber and coal mining. Nevertheless, a degree of stabilization has occurred after initial population losses were incurred. Organized community action is working to diversify the economy and take advantage of the resources and opportunities that are within the area.

Subregion 9

Subregion 9 lies in the geographical center of Pennsylvania. The northern portion of this area is located in the high heavily wooded tablelands of the Allegheny plateau through which streams have cut deep narrow valleys. The southern portion of the subregion contains parallel ridges and broad valleys. Winding throughout the subregion, the West Branch of the Susquehanna and its tributaries carved a path from the northern forest through the Allegheny Front, west along Bald Eagle Valley, and south through the ridges and valleys toward the Chesapeake Bay.

The first settlers came to the subregion about 1770, following the river valleys into the interior. The wide valleys in the flood plains contained flat land suitable for farming. Most of the settlements in this area were located in the West Branch and Bald Eagle Valley along the Susquehanna and Bald Eagle Creek, for water was the power source for grist mills and saw mills.

After local farms were established in the valleys, the area grew more slowly until about 1800 when iron ore was mined, smelted in charcoal furnaces, and made into tools and implements. Small forges and factories were located along the streams because water was necessary in the smelting and forging process.

The upper Susquehanna region was opened to exterior commerce when the West Branch Canal was constructed along the river in 1834. The Canal reached from Sunbury to Lock Haven with an extension along Bald Eagle Creek to near Bellefonte. This improved transportation significantly and was a stimulus to development of the region. Before the canal was built, shipping on the shallow and rocky West Branch was hazardous.

Canals were only the beginning of improved transportation; in 1839, the Williamsport and Ralston Railroad was constructed along the Susquehanna and gave additional economic importance to towns that were located along the river. For example, Renovo became a railroad town when the Philadelphia and Erie Railroad built car shops and yards and the Pennsylvania Railroad built shops for general repair work. Many other small communities became minor railroad centers.

About 1840, the lumber industry began to develop in the north woods. At this time there was a growing demand for lumber to build ships, homes, tools, and implements; even new machinery was made of wood. Great resources of timber were located in northern and northwestern Pennsylvania, and almost overnight trees were cut by the thousands and saw mills were built along the waterways to meet the demand. Thousands of logs were floated and rafted down the West Branch to lumber depots. A boom was built in Lock Haven to collect and sort the logs - the boom gathered the logs floating down the river. The town of Lock Haven became a lumber center frequented by woodsmen and rivermen. It was named for the locks once found in the Susquehanna at that location and the haven the town offered to the timber raft crews. Similarly, many communities developed to service the needs of the logging crews. However, by 1890, the forests were depleted and the resource base of the economy was gone.

Not all the communities in the subregion derived their origins from the lumber industry. Many towns, such as Bellefonte and North Bend, mined clay and were way stations for westbound travelers, and State College, Pennsylvania, became an educational center. Just before the Civil War there was a strong demand for education in science, engineering, and agriculture to keep pace with technological advances in the country. In 1855, the Farmer's

High School, sponsored by the State Agricultural Society and interested individuals, was chartered to teach better methods of soil cultivation. From this beginning it grew into the Agricultural College of Pennsylvania and shortly was named the Pennsylvania State College. The school was designated as the state's land grant college by Act of Assembly in 1863. Penn State has grown over the years and has made a significant contribution to the area economy. The college has provided not only employment but its faculty has attracted research and development companies, which have been the basis for new employment in the region.

Originally, agriculture, then iron and lumber, were the predominant industries of the subregion. Agriculture is still important; iron has been replaced by limestone as the leading extractive industry - the limestone is manufactured into quick lime, fluxing stone and other products; the lumber is gone but employment has been gained in local manufacturing. Although the previous major industries have declined in the area, the growth and development of State College has played a significant role in the continuing growth of the subregion.

Subregion 10

The northern section of Subregion 10 is located within the dense forests of the Appalachian plateau, whereas the southern area is located within the ridge and valley terrain of the Appalachian Mountains. Winding through the subregion is the West Branch of the Susquehanna River; it cuts across the mountain ridges and was the first highway for the pioneers traveling west. The West Branch flows south to Northumberland and joins the North Branch to become one river - the Susquehanna.

Frontiersmen were the first Europeans to come to the subregion. However, the land belonged to the Indians and whites were often killed. During the French and Indian War, two frontier forts, Big Island and Bald Eagles Nest, were built in the area. The forts were located at strategic points guarding gaps through which Indian paths led from north or west. Most of the forts were hastily built and utilized local militia to defend the frontier. War with the Indians and uncertain land titles retarded settlement, but the Treaty of Fort Stanwix in 1768 opened the interior to settlers. Still there were many boundary disputes and questionable land titles as squatters (persons without title) were everywhere. One group of squatters who settled west of Lycoming Creek called themselves the Fair Play men and set up a tribunal to decide disputes between themselves and the Indians. Decisions by the tribunal were enforced by expelling offenders from the territory. After the second Treaty of Fort Stanwix in 1784, the Indians relinquished title to the land and the Fair Play men obtained legal claim to their homesteads.

Waterways provided transportation and communication, and in the valleys there was flat land for farms and settlements. In addition, the water powered the first grist and saw mills which provided flour and building materials for the frontiersmen.

Settlements along the river grew slowly until 1840, when the lumber industry began to develop. There was a growing demand for lumber to build ships, homes, tools, and implements; at that time practically everything was made of wood. Vast resources of timber were located in northern and northwestern Pennsylvania. After the trees were cut the logs were floated and rafted down the Susquehanna's West Branch. Much of the river was shallow, but the water deepened at Williamsport and a low sloping bank made handling logs easier; thus Williamsport became the lumber depot and many saw mills were built in town.

A turning point for lumbering came with the formation of the Susquehanna Boom Company and the completion, in 1850, of the Williamsport Boom. The boom gathered the logs floating down the river. Other booms in the river, such as those at Jersey Shore, also served for the collection and sorting of logs, but the seven-mile-long Williamsport Boom was by far the greatest. It made Williamsport the key spot on the river for the lumber industry and for some thirty years the lumber capital of the world.

At the outbreak of the Civil War, Williamsport had 6,000 residents. Ten years later there were 16,000 inhabitants, two railroads, and thirty large saw mills producing more than 300 million feet of sawed lumber annually. Other towns along the river did not grow as large as Williamsport but became trade centers and provided services for the logging crews.

By 1890, the forests were depleted, and the resource base of the economy was gone. In 1839, a Last Raft was assembled and launched as a final tribute to rafting and raftsmen. It carried a crew of six and fifty passengers. The trip ended in tragedy when, after hitting a railroad bridge at Muncy, the raft broke up, and seven persons were drowned.

Although the early lumber industry stripped the forest, there has been some recovery. New forest covers much of the region, but timber of suitable quality is scarce. However, there is enough lumber to support a limited industry of a few saw mills, furniture factories, and paper mills.

Subregion 11

Subregion 11 is located in the eastern part of the Allegheny plateau and the western portion of the Appalachian ridge and valley terrain. The Juniata River winds throughout this subregion as it has two points of origin. Rising in Bedford County the Raystown branch is the larger of the two; it flows over a hundred miles through rugged mountain country. The Frankstown branch rises in Blair County and is only fifty-six miles long. Both branches join to form the main river at Huntington, which then flows eighty-six miles to join the Susquehanna at Clark's Ferry. The Juniata is narrow but deep; it follows a valley that winds through rugged mountains into the heart of the Alleghenies and was a primary route of settlement.

Before the American Revolution this area was occupied primarily by the Indians. There were a few early settlers, such as those in the Sinking Spring Valley, who were occupied with mining lead for Philadelphia markets. However, Indian attacks were frequent and the settlers often sought protection at Fort Roberdau, one of a series of frontier forts that had been hastily constructed to protect British outposts and frontier families.

After the French and Indian War and the American Revolution, a treaty was reached between Pennsylvania and the Indian nations. Westward land was open and settlers moved to the new lands in great numbers. Because of the rugged terrain and poor soil, farming was confined to the river valley. Since food and shelter were the primary considerations for existence, grist mills and saw mills were constructed along the waterways. Thus, settlement was very much river and stream oriented.

The population in most of the area was sparse for many years and increased very little up until 1830. At that time, however, the building of turnpikes, canals, and railroads began to advance, linking this remote section with eastern markets. For example, Hollidaysburg was founded in 1768 by Adam and William Holliday, who were Irish immigrants. Town population leaped from 72 to 1,896 between 1830 and 1840, when the first unified transportation system was completed across the state with the Portage Railroad between Johnstown and Hollidaysburg as the key link.

Spurred by the completion of the Erie Canal in 1825, the Pennsylvania legislature authorized construction between Philadelphia and Pittsburgh of a complete system of rail - water transportation; this was completed in 1834. The Portage Railroad was an ingenious system of levels and inclined planes over the mountains between Hollidaysburg and Johnstown connecting the eastern and western canal terminals. At its most efficient period, the Portage entailed thirty-three power changes and was easily disrupted by winter ice and spring floods. Twenty-three years after the line was built, it was purchased by the Pennsylvania Railroad.

The development of Altoona was similar to that of Hollidaysburg. In 1849, the town was laid out; five years later railroad lines were extended over the Alleghenies to connect Pittsburgh with the East. German, Scottish, and Irish immigrants soon appeared. Further in-migration ensued when the Pennsylvania Railroad Company purchased thirty-five acres for depot offices and shops, and Altoona became the center of the railroad operation between the east coast and the midwest.

The broad top field of bituminous coal, located southeast of Altoona also played a role in the area's development. The transportation network within the area brought coal to its markets. Machine shops and repair shops were constructed to service the mines. Furthermore, industries established near the mine fields were an indirect product of mining. For example, because the mines provided little employment for women, industries such as textiles, silk, and apparel developed and employed women exclusively.

The demand for soft coal was generated by an expanding steel industry and much of the subregion's coal was consumed by the steel mills of Johnstown. Also, the railroad used vast amounts of coal in their steam locomotives.

The nature of the bituminous coal mines affected development. Wide dispersal of coal seams meant that miners were on the move. This tended to make mining towns or camps small and isolated.

Although much of the area remained rural, there was a degree of local industry as factories developed in the river valleys. The flood plain contained flat, broad expanses of land, railroad lines for transportation, and water which industries needed for cooling, cleaning, and processing. The river was also a dumping ground for wastes.

The area economy faltered when the coal and railroad industries began their decline after World War II. Employment in the mines decreased as the demand for coal decreased and as mining automation increased. Coal lost much of its market to oil and gas, which were easier to transport and store. Railroad jobs were lost to the diesel engines and to the use of automobiles and trucks.

A program of development launched by local citizens and political leaders is improving economic conditions in the subregion. New jobs are being created in manufacturing, wholesaling, retailing, and the service section. Additional employment may be found in the growth of tourism, which will offer even more diversity for the future.

Subregion 12

Subregion 12 is located in the Appalachian Mountains. The Juniata River, which is a major tributary of the Susquehanna, cuts across the high parallel ridges that run in a northeast-southwest direction. It was the river that provided the major transportation route between the eastern and western areas in the state.

The earliest settlement within the subregion occurred about 1750. First the Scotch-Irish, Irish, and Germans came and established farms in the valleys. Grist and saw mills were constructed along the river and creeks to provide flour and building materials.

Although farming was possible, the valley of the Juniata and the surrounding region became, after 1790, a center for the making of an especially high quality iron which came to be known as "Juniata Iron". By 1838, Mill Creek Furnace was built and the area became one of the most extensive iron fields in the world. Mill Creek Furnace, just one of several in the subregion, operated from 1838 to 1869. At its peak, 120 men were employed in producing sheet iron. The area was well supplied with water power, timber, and limestone which were necessary to make pig iron.

Charcoal iron furnaces were built of limestone in the shape of a pyramid and lined with hard sandstone. The furnace was filled from the top by placing alternate layers of iron ore, limestone, and charcoal. When the charcoal was lighted the furnace was put in "blast". A water-powered bellows then fanned the furnace with a cold blast of air. This meant that furnaces had to be located close to a stream which could turn the water wheel to power the bellows. As the mass within the furnace melted, the limestone acted as a flux and absorbed the impurities in the ore. The molten iron dropped to the bottom of the furnace and was tapped and drawn off into sand casting beds.

Further refining was necessary before the pig iron could be made into implements. During this process the pig iron was pounded out by a large iron forge hammer. This was an up-and-down device made of large timbers with a heavy iron hammer at the end; it operated by water power. Additional impurities were driven out in this process, and an iron bar was the result. A bar of iron was fourteen feet long, two inches wide, and one-half inch thick.

Both the ore and the finished sheet iron were transported by canal, as the Juniata River was part of the main line of the Pennsylvania canal system. From Duncan's Island on the Susquehanna to Hollidaysburg, the Juniata division was 132 miles long and was opened to Lewistown in 1829. This canal system extended from Pittsburgh to Philadelphia and was in use by 1834. The Pennsylvania canal system was constructed as Pennsylvania's bid for western trade. It was recognized that the trade of the developing West was a prize worth competing for, and that it would be captured by the Atlantic port which offered the quickest and cheapest transportation to the seaboard. New York state had constructed the Erie Canal, and Philadelphia was threatened with the loss of western trade to New York. Furthermore, Baltimore was a serious commerical rival as it was the natural outlet of the Susquehanna River, and Baltimore was ninety miles nearer to Pittsburgh and the Ohio River than was Philadelphia.

Within twenty-three years, in 1857, the State of Pennsylvania sold the main line of the Pennsylvania canal to the railroad. The Columbia Railroad, out of which grew the Pennsylvania Railroad, had been built as a canal link between the Delaware and the Susquehanna. In a few years the railroad was earning more than all the state canals, and the railroad became the new era in transportation.

The advent of the railroad stimulated the market for iron and eventually steel. Local steel mills in Burnheim and Yeagertown produced locomotive castings, wheels, and axles.

Although the area prospered, the iron industry was not long lasting, as Pittsburgh became the "Iron City" in the state. Local industry and agricultural and trading centers developed along the river and creeks in the subregion; however, the topography of the area limited development. The high ridges created a degree of physical isolation not only between valleys but also from the surrounding urban centers of Harrisburg, Altoona, and State College. Lewistown was the one place that developed an industrial and mercantile center in the subregion. Much of the area is rural and is expected to remain so.

Subregion 13

Subregion 13 is located in the south central portion of Pennsylvania with the southernmost area bordering on the State of Maryland. The region is pervaded with creeks that wind through the valleys and form the headwaters of the Potomac River.

The first settlers in the area were Scotch-Irish and English, who were followed by Germans and Swiss. In the eastern portion of the subregion lies the Allegheny plateau, and here the first agricultural villages were established. Further west is an area of ridges and valleys, and settlers that crossed the ridges established farms in the valleys. The earliest settlements were located along the creeks because water was necessary to power the grist and saw mills. These mills provided flour and building materials which were basic necessities.

Farming in the western ridge portion of the subregion was not as successful as in the eastern portion. The major agricultural areas were located on the Gettysburg plain and in the Cumberland valley. The Gettysburg plain, which is part of the Allegheny plateau, is separated from the Cumberland valley by South mountain. Here were the rich fruit lands and, consequently, the area is repleted with peach and apple orchards.

Many of the Pennsylvania frontier forts during the Revolutionary period were located in this subregion. Fort Loudon, as an example, was settled before 1756, when a crude fort was erected by Colonel John Armstrong and named for the Earl of Loudon, who for a brief period commanded the British forces in the Colonies.

The Conococheague valley served as a buffer area between Indian country and the more densely settled sections; during uprisings the full force of Indian anger was directed against remote settlements here. Pioneers erected cabins, cleared land, and tilled their fields under constant threat of Indian attacks which, when they came, had to be repulsed with little or no aid from the King's forces. Philadelphia merchants aggravated matters by sending westward train after train of pack horses laden with trinkets, knives, guns, ammunition, and rum to be traded with the Indians for furs.

An incident at Fort Louden, ten years before the Battle of Lexington, reveals the growing spirit of revolt in the American Colonies. The homesteaders took the law into their own hands in 1765, less than a year after a band of Indians had killed nine children and a schoolmaster. A pack train traveling to the Ohio forks was raided by the settlers. The British soldiers captured and imprisoned eight of the settlers, but their release was gained by capturing enough British soldiers to effect an exchange. After other such incidents, three hundred settlers laid siege to the fort, eventually forcing withdrawal of the garrison.

It is this eastern portion of the subregion where the three largest settlements grew - Chambersburg, Waynesboro, and Gettysburg. Although there are many other areas within the subregion which have developed as trading centers, these are the largest. It was also in these towns and in this area that bitter fighting during the Civil War took place.

General Lee's forces were located nearby in northern Maryland and were preparing to invade Pennsylvania. In 1861, eighteen hundred of Lee's cavalry occupied Chambersburg. The city was a major supply center for Union forces and the Confederates destroyed army stores and took horses and supplies. General Lee was preparing his invasion to strike at the heart of the northern industrial and transportation system. Central Pennsylvania was a choice target with Harrisburg as the railroad center of the north, the Susquehanna River bridges the lifeline for moving troops and supplies south, and the concentration of northern industry within the area.

Waynesboro is further south and just over the border from Maryland. On his raid into Pennsylvania, General Early entered the town and demanded food for his army.

Gettysburg was a quiet college town before the Union and Confederate armies clashed. But then it became the scene of the heaviest artillery duel ever fought on the American continent. On July 13, 1863, 75,000 Confederate soldiers fought against 84,000 Federals in an attempt to carry the war to the north. More than 50,000 were killed, wounded, or missing. Although the town did not suffer greatly from the battle, it became a vast hospital and cemetery. Eventually, the U.S. Government set aside part of the battlefield as a military national cemetery and park. At the dedicating service in 1863, Abraham Lincoln made his immortal address.

Although the subregion was settled early and major historical events took place here, the area has remained rural. Farming has played an important role in the development of the region and will continue to do so in the future.

Subregion 14

Subregion 14 is a small area (96 square miles) in north central Pennsylvania that forms the headwaters of the Genesee River. From its source in Potter County, the river rises in the Allegheny Mountains and flows northward to Lake Ontario; it is one of the few north flowing rivers in the northeast. The area within this subregion is sparsely settled as its heavy forest cover is only broken occasionally by small dairy farms.

The first settlers that came to the subregion in the early 1800's were searching for lumber because the area did not lend itself to farming. Poor soil and rough topography made even primitive farming impossible; however, the area was heavily forested with oak. The timber was cut and burned to clear the land, and in many settlements the first money was secured from the sale of ashes or from the sale of charcoal. Potash salt was derived from the ashes;

this was used in making soap, glass, and in the process of scouring wool, bleaching and dyeing cloth. Charcoal was used by blacksmiths and in smelting iron ore. By 1830, there were tremendous lumbering operations located in this region and nearby, along the Allegheny River. At this time, timber was in great demand as it was used to make a multitude of products; homes, ships, tools, railroad ties and trains, barrels, and machinery to name a few.

Saw mills and lumber camps were located along the river. The water powered the mills, and after the timber was cut it was floated down local creeks to the Allegheny or Susquehanna Rivers. Many lumber camps evolved into towns, but settlements also sprang up to serve the needs of the lumber industry. Lumbering in the nineteenth century was more than an industry; it was a way of life with a defined social system and economic order. Here was a melting pot where the English and Scotch-Irish, who owned most of the wooded lands at the headwaters of the river, joined New Englanders, who contributed their traditional knowledge to the commerical part of the business. There were also a number of French Canadians, whose experience in the forests of Quebec had made them experts at building chutes on small streams to carry the logs around falls.

Within twenty to thirty years the lumber companies had depleted the forest, and when the timber was gone the lumbermen went on to other timber regions. The small towns they left behind were deprived of their economic base and had few resources left. These towns, subsequently, have not grown, and many communities remain in this mountainous region with half as many people as there were in 1900. This sizeable out migration reflected the economic decline that occurred when lumbering operations ceased.

A system of forestry management has been developed in the subregion, and, although the lumber industry will never be as large as it was in the past, it is hoped that increased employment will result if this industry can be restored.

Subregion 15

Subregion 15 is a small area that comprises the Erie plain, a portion of the Erie triangle, and the entire shoreline of Lake Erie that lies along the Pennsylvania boundary. Also included is the city of Erie, Pennsylvania's northernmost city and the state's only port on the Great Lakes. This harbor is the best on Lake Erie as it is landlocked by a curved peninsula seven miles long.

The area's first inhabitants were Indians of the Eriez nation, from which the lake and, later, the city received their names. They were conquered by the Seneca about 1654, and, thereafter, the region remained under the control of the Iroquois Confederacy. In 1753, a French force originating in Montreal, recognizing the strategic possibilities afforded by the sheltering arm of the peninsula, established a fort at Presque Isle. By 1760, however, French claims to the Ohio valley had been shattered and Fort Presque Isle was abandoned to the conquering English who soon garrisoned the port.

In 1784, Pennsylvania acquired by treaty with the Six Indian Nations all land in the northwestern part of the state except the triangular tract fronting on Lake Erie, as Connecticut, New York, and Massachusetts had claims to this area. Congress, taking up Pennsylvania's plea for adequate frontage on the lake, requested New York, Massachusetts, and Connecticut to relinquish their claims to the territory. It was, therefore, deeded to the U.S. Government, and in 1792, was sold to Pennsylvania. However, the Indians resisted colonization and permanent settlement was not established until 1795.

The area grew slowly, but by 1805, the town of Erie was incorporated as a borough. The settlements established in the subregion consisted of small bands of New Yorkers, New Englanders, Scotch-Irish, and German pioneers from southern Pennsylvania. As settlement increased, sawmills, gristmills, brick yards, foundries and other enterprises developed.

The subregion is ideally suited for farming. Lake Erie was once larger, and the total plain is the bed of the once huge lake, thus the soil is very fertile. Lake Erie also tempered the climate, prolonging the normal growing season while providing a constant cooling breeze. These factors combined to make the area suitable for farms, orchards and vineyards, while the port served as the distribution center for agricultural products.

Prior to the War of 1812, there were about a dozen merchant ships on Lake Erie, with salt and furs the principal commodities. Roads were poor and crude wagons were drawn by oxen. By 1826, however, three steamboats and several schooners cleared from the port every week, and by 1846, daily steamboat service had been established between Erie and Buffalo. With the opening of the Erie and Pittsburgh Canal in 1844, and the advent of the railroads in the 1850's, the area grew considerably.

Another function of the lake was to provide transportation facilities and water for Erie and its industries, as the port was a magnet for industrial and commercial development. Thus, the lake indirectly determined the population composition, for Germans, Poles, Russians, Italians, and other nationalities were drawn to the area in the late nineteenth century, not only by the mills and factories, but by the fishing and shipping. Ships delivered pulpwood, iron ore, limestone, and grain to the area and carried out coal, oil, and manufactured products.

The subregion has experienced steady growth and a stable economy through the years. Lake Erie fishing has suffered a serious decline from pollution, although some steps are being taken to alleviate the situation. There has been some unemployment in the city of Erie, but civic leadership and state aid are creating new employment opportunities for the area.

Subregion 16

Subregion 16 is located on the upper Allegheny River Basin. The area was first claimed by the French as part of their Ohio Valley territory. However, the French alliance with the local Indian tribes was weak as the Indians were on friendly terms with the rival English traders. The absence of a strong alliance between the French and the Indians enabled the English to occupy this territory and defeat the French without the major battles that ensued in other parts of the state.

At the end of the 17th century, a tide of Scotch-Irish immigration flowed into Pennsylvania and continued unbroken for years. Because the eastern region was already appropriated, mainly by the English and Germans, the Scotch were forced west of the Susquehanna River and, finally, beyond the Alleghenies. Many came to Pittsburgh and from there traveled up the Allegheny River to the subregion.

These early settlers came to farm, and many settled in the western part of the subregion where the gently rolling hills and sandy soils encouraged farming. However, the north and eastern parts of the subregion lay in the Allegheny plateau, and here farming was difficult. Poor soil, wooded hills, narrow winding valleys, and the cool weather combined to make farming practically impossible. Thus, the north and eastern portions of the subregion were sparsely settled.

Although the land in the subregion was not suitable for farming, the area was heavily forested and lumbering became an important industry. Sawmills and lumber camps were established along the river as the logs could be transported downstream to Pittsburgh. Lumbering reached its peak between 1830 and 1840 because, at that time, wood was the basic material in making kegs, barrels, boxes, ships, and almost every form of tool or implement. The forest also provided charcoal for the iron industry. Demand for lumber was insatiable, and the trees were cut until the forests were stripped bare. When the timber was gone, most of the population left too; only sparse settlements remained.

History was repeated when, in 1859, the region became transformed once again by E. L. Drake's discovery of oil near Titusville. News of Drake's well spread and oil fever raged over northwestern Pennsylvania, carrying the prospect of making fortunes in oil. Lands were bought and leased as oil wells multiplied at various points along Oil Creek Valley and throughout the territory bordering on the Allegheny River. By the close of 1860, a number of wells had been drilled and were producing, with the oil field extended along the Allegheny from Tidioute to Franklin.

Although oil had been used in the subregion by the Indians as early as 1768, until the middle of the nineteenth century there was no commercial use for the greasy petroleum. It was the decline of the whale that gave petroleum its commercial boost. Whale oil and tallow candles were the world's main illuminant but, about 1850, the whale supply began to dwindle, and inventive minds turned to other sources of illumination. A process of distillation produced a refined burning oil called kerosene that revolutionized home lighting.

Two major problems were associated with the oil discovery. First, storing the oil that gushed from the well, and, secondly, transporting it to market. Barrels for storage could not be shipped in fast enough; consequently, barrel factories were established in the oil regions to meet the demand. Once stored, the oil was transported by canoe or dugout to Pittsburgh. Soon this means gave way to flat-bottom boats loaded with oil in barrels and, eventually, tanks. The transporting business grew into an oil fleet of about 2,000 boats, comprising a variety of river craft, with a capacity ranging from 50 to 1500 barrels.

A by-product of the oil discovery was the boom town, and Pitholes was a classic example. An oil discovery in the area created a town of 15,000 in a few months; within a year the oil ran out and Pitholes became a ghost town. Those that came to the boom towns were speculators or swindlers trying to get rich quick. They were not settlers that form the fabric of a permanent community. By the turn of the century most of the oil was depleted. Once again, only small communities remained behind with an occasional mansion as a reminder of the previous riches that were gained.

Today, the western portion of the subregion is linked with the industrial city of Pittsburgh and those in Ohio. Lying in the center of the subregion is the Allegheny State Forest, which supports a substantial recreation industry. The eastern portion of the subregion is heavily forested and, although the lumber industry has declined, many small towns in the area are supported by employment derived in forest related industries, such as furniture and other lumber products.

The rural character of the subregion has remained unchanged, although the area has been the source of vast quantities of timber and oil. Generally, the subregion will remain rural and, thereby, be a recreation source for the metropolitan areas in Pittsburgh and in eastern Ohio.

Subregion 17

Subregion 17 is located in the plateau country between the Allegheny River on the west and the slopes of the Allegheny Mountains on the east. North of the region is the Allegheny National Forest. This is a rugged region, scarred in part by intensive industrial development. Neat patches of farm land are occasionally visible with creeks and riverlets throughout the area. Thick woods are at the edges of farm land and on the mountain sides.

Waterways in the area played an important role in the subregion's development. The rivers were the arteries of transportation and the link with Pittsburgh. Also, the water powered the flour mills, saw mills, forges, and factories.

The earliest homesteaders arrived in 1791, but many, discouraged by Indian attacks and uncertain land titles, continued westward; the first permanent settlement was made after 1796, by Germans and Scotch-Irish.

This is an area rich in natural resources, and thus the first settlements were lumber communities established along the streams and rivers which powered the saw mills; after the timber was cut the logs were floated or rafted downstream to Pittsburgh. By 1884, the forests were stripped of their timber, but about 1890, the tanners made an alliance with the lumber people. Pennsylvania tanneries needed hemlock bark to tan hides, and for some time bark speelers, as they were called, stripped standing hemlock trees of their bark. Pennsylvania held first place in the leather business and, like the early iron industry, needed the forest's basic resource - the bark. Eventually, it was realized that the trees themselves were a source of income as lumber.

Tanning leather and lumbering merged about 1890, and out of the merger came the largest scale industrial development of the forest resources of northern Pennsylvania.

In the western part of the subregion, vast resources of coal and iron stimulated growth in the iron industry. The exploitation of anthracite and soft coal and the accompanying growth of the iron industry was the most important factor in industrialization. In 1839, the Great Western Iron Works opened, marking the beginning of a forty year boom that gave employment to thousands. The iron industry was stimulated by the introduction of the hot blast system and the use of coke instead of charcoal as fuel. At the height of activity, 40 blast furnaces roared in the wilderness of Clarion County.

Coke made from bituminous coal was used in blast furnaces because of its freedom from impurities. The earliest coke could not withstand blast furnace pressure, and, after considerable experimentation, special ovens were devised. The beehive oven produced good coke but allowed the escape of coal tar, ammonia, and benzol. These ovens were made of brick, earth covered, and built in rows. Soft coal was burned in the oven for two to four days, and when the mass reached the proper state it was sprayed with water and then drawn out. Beehive ovens were numerous in the subregion.

Brady's Bend Iron Company in Armstrong County made the most extensive use of coke in a large scale iron making operation. This was one of the first vertically integrated industrial production concerns in which the Company owned the land, the village, and the factory which rolled large quantities of iron rails.

A technical change in making coke precipated the region's decline in this industry when beehive ovens were replaced with by-product ovens. The by-product oven, introduced into the United States in 1892, preserved by-products, produced more coke per ton of coal than the beehive, and completed the process in far less time. Installation and operation of the by-product oven was extremely expensive and few were constructed in this area. Local bituminous coal fed the beehive oven, and when it declined in use the demand for local coal declined.

Shortly after 1850, iron furnaces, glass works, tanneries, brick yards, oil wells, and farming supplemented coal mining activities. Oil discovery in the area resulted in short-lived economic booms but this did not provide long range employment. General farming was not widespread as the soil was not fertile; however, local farming was practiced.

The extraction of minerals and resources has dominated the landscape and development in the subregion. This has been especially true with regard to bituminous coal. The coal lies near the surface and is strip mined; that is, it is literally scraped from the earth. Great scars are left and, if the surface is not reclaimed, serious erosion, despoiling, and water pollution are the result.

Although coal mining is still important to the subregion, since World War II coal has suffered a major decline. Much industrial use of coal has been replaced by other energy sources - electricity, gas, or oil. Nevertheless, the subregion is an area of great natural beauty and would benefit from the development of tourism and recreation. One of the problems facing the area is the present incompatibility between strip mining and maintaining areas of scenic beauty to attract tourists.

Subregion 18

Subregion 18 lies within the steep slopes of the Appalachian mountain plateau. The Allegheny River transverses the region as it flows southward from New York State to its confluence at Pittsburgh. The river and its tributaries were the early highways that provided transportation and communication for the first settlers.

Although the first European settlements were French military outposts, their presence was brief. French claims to the area lasted nine years until 1758 when English forces drove the French out. Permanent settlement was accomplished by the Scotch-Irish. They were the frontiersmen of the time and led the westward advance of settlement, forming the first line of defense against the Indians and bearing the brunt of the Indian wars. The Indians had been allied with the French hunters and trappers but attacked the colonials that farmed and settled traditional Indian hunting lands. The Quakers governing in Philadelphia were non violent and would send no soldiers in military support. The Scotch-Irish were bitter, angry, and isolated. This isolation became manifested as intense political involvement. The Scotch-Irish started upon their career of political activity in bitter opposition to the Quaker party and the commercial interests of the east. These farmers - more than 100 miles from Philadelphia were deprived of their market. Thus the only way they could market their cereals and grains was to transform them into distilled liquor. Its relatively small bulk and high commercial value made it possible to convey this product long distances at a profit. In 1791 a tax on whiskey was levied by the excise law enacted by Congress as part of Hamilton's program - Scotch-Irish opposition arose as the Whiskey

Rebellion. These settlers took up guns and threatened to destroy the government in Philadelphia. A show of force quieted the rebellion but the area became a democratic stronghold for Jefferson.

Many of these settlers had built their log cabins along the Allegheny River valley. The farmers were attracted by the fertile bottomland, the relief from the steep rugged terrain and the river provided transportation and water power for iron works, and grist mills. These settlements along the Allegheny became the communities of Etna, Sharpburg, Tarentum, Natrona, Freeport, Ford City, Kittaning and Johnstown.

Johnstown was an important link between Philadelphia and Pittsburgh. The Pennsylvania canal was built to transport passengers and goods between Philadelphia and Pittsburgh. The western section from Pittsburgh to Johnstown was completed in 1830. The canal crossed the Allegheny and ran along the Kiskimenetas and Conemauga rivers to Johnstown, where passengers changed to the Portage Railroad. On the inclined planes of the mountains the cars were pulled up and let down by stationary steam engines, while on the level stretches they were pulled by horses.

At Hollidayburg the travelers moved into a boat which took them on the Juniata and Susquehanna rivers to Columbia. A railroad car then took them to Philadelphia.

Although Johnstown was an important transportation station its major industry was steel manufacturing. In 1858 the revolutionary Bessemer process was patented in Johnstown. Sir Henry Bessemer, an Englishman, had invented a special furnace, or converter, which made steel by forcing a purifying blast of air through molten cast iron. Andrew Carnegie had seen the process demonstrated in England and brought the process to the Pittsburgh area. Steel rolling mills in Johnstown stimulated economic growth and employment in coal mining, fire brick making, and in transportation.

The Allegheny River and its tributaries provided the power source to operate the rolling mills, cooling water for the mills, and served as the means for transporting goods. It was necessary for Johnstown, Pittsburgh and other communities to be located on the rivers. However, as a result, serious floods have swept through the area and in their wake left untold damage and destruction. One of the worst floods occurred at Johnstown in 1889, in that flood three thousand persons died. Subsequent flood control dams have reduced the number of floods, especially along the tributaries of the Allegheny which carry the greatest volume of water.

In addition to floods, water pollution is a serious resource problem. Industrial dependency upon water and coal have resulted in pollution involving both industrial waste and acid mine drainage.

Although the subregion is predominately rural it is not an agricultural area. Instead there are a chain of industrial river valleys and small mining towns that wind towards Pittsburgh, the industrial heart of the region.

The industrial hay-day and predominance of the area lasted until the early twentieth century. As long as coal was King the area prospered. But with the decline of coal and the ascent of mechanization in both the mines and the steel mills, unemployment became a tremendous problem. The area was confronted with social and economic difficulties and a significant outmigration of population.

Currently, people in the subregion are wrestling with the problems of education, employment, economic growth and regional development. No doubt, future plans also will be able to capitalize on the same physical and natural resources that played such a vital role in the area's early history.

Subregion 19

The history and development of Subregion 19 flows from the geography and natural resources of the area. The steep hills in the area are incised by narrow river valleys. Occasionally level land could be found on the flood plains of the wider valleys. Thus, geography dictated where settlements could be established.

The French were the earliest European settlers in the subregion. Principally hunters and trappers; they had no land disputes with the Indians, consequently they became allies.

In 1749 the French built Fort Duquesne on a triangular flood plain formed by the juncture of two rivers. Fort Duquesne commanded a strategic point on the threshold of the river forks that would allow the French to control access to the great interior of the continent - the Ohio Valley. They had laid claim to this area and the military outpost could launch attacks against the English who were anxious to dispute the French claim to the territory.

This region west of the Alleghenies in southwestern Pennsylvania did have a few English settlers, but most came not from the eastern section of William Penn's province but from Virginia and Maryland. The tide of settlement which had moved steadily westward to the Alleghenies was arrested by the mountain barrier and deflected southward through the Cumberland Valley. A few pioneers from Virginia and Maryland entered the trans Allegheny region as early as 1753 by way of Braddock's Road, which was an Indian trail from Cumberland, Maryland to Pittsburgh. General Braddock and his British forces launched their first attack against Fort Duquesne in 1755. The British were defeated and Braddock was killed. However, in 1758 the British, using Braddock's

Road, marched on Fort Duquesne, defeated the French and renamed the Fort - Pitt, after the Prime Minister of England - William Pitt. Although a few settlers had crossed the Alleghenies as early as 1750, it was not until these lands were formally opened up for settlement by the land purchase of 1768 that important immigration into trans-Allegheny Pennsylvania began. For some years the conflicting claims which Virginia and Pennsylvania held to this region produced much confusion in land titles. Consequently there was restricted settlement under Pennsylvania title and most of the pioneers in the section were from Virginia.

During the Revolution the westward immigration slackened but increased after the war when migration came from Pennsylvania east of the mountains.

Pittsburgh was then a struggling village with a population of 1,200 and about to enter upon a career of rapid progress. Pittsburgh grew because of its geographical location. The mountains in the east made transportation from the seaboard hazardous and expensive. Thus the people of the town had to rely on themselves to produce the things they needed. The two great rivers - vital arteries of communication and trade - that flowed together at Pittsburgh boosted its development. The Allegheny, coming from the north, connected northern Pennsylvania with the southern part of the state, while the Monongahela flowing from the south, tapped the commerce of northern Virginia and the eastern corner of western Pennsylvania. It was in Pittsburgh that overland and river traffic met. It was here that the goods brought over the mountains on the back of packhorses or in conestoga wagons were put in the river boats which transported them and the region's goods down the Ohio and the Mississippi.

The canoe had been the means of river transport until after the Revolution when keelboats, flatboats, and arks came into use. A large demand arose for such boats to convey immigrants with their goods from Pittsburgh, the "Gateway of the West" down the Ohio to Cincinnati, Louisville and other river ports, where they disembarked to seek their destinations in Kentucky, Ohio, and the Northwest Territory. These western pioneers could buy equipment, tools and flatboats cheaper in Pittsburgh than in the eastern cities. The flow of this immigrant money helped Pittsburgh to prosper.

At the beginning of the 19th century the iron industry started to develop. Iron began to be manufactured west of the Alleghenies in Fayette County as early as 1790. However, the use of coal and iron was just beginning when the war of 1812 isolated the United States and stimulated manufacturing which eventually led to the development of the factory system. Before 1840, most American iron was smelted from charcoal rather than from coke. Since both timber and iron deposits were widely scattered throughout the county, the geography of the iron industry was determined, not by the location of raw materials, but by access to markets and the availability of labor. After 1840, new techniques for smelting iron were introduced which utilized coke rather than charcoal. Bituminous coal (anthracite was not used in this process until a later day) was localized in a few great deposits around Pittsburgh.[7/] With the manufacture of iron gravitating to the coal producing regions, Pittsburgh rose rapidly to a commanding position - other areas shared in Pittsburgh growth. Settlements had grown along the Monongahela River - Braddock, Homestead, Duquesne, McKeesport, Chairton, Donera, Monesson and California - and many communities developed near the coal fields.

The rivers and conestoga wagons furnished transportation until the network of railroads and improved highways covered the State. After 1860, the network of railroads allowed for easy shipment of raw materials and goods to Pittsburgh and from there to central markets. Also by this time flatboats

---

7/ Connellsville coke

had given way to steam and Pittsburgh had become an important center of steamboat activity.

After the Civil War, industrial progress was characterized by the full development of the factory system, enlarged capital resources, increased use of migrant labor, international markets and the concentration and specialization of industry. Household industry and the shop gave way gradually to the factory. The growth of iron and steel manufacture continued with the Pittsburgh industrial areas the great center of this industry. Iron works produced stoves, pipes, hardware, cannon, steamboats, railways and steam ships. Iron rolling was stimulated by the growth of railroads, bridge building and beams for buildings and Pittsburgh became a center of western boat building.

Although the subregion experienced rapid economic expansion and growth, this was predicated on the widespread use of coal as coal mining was a principal source of employment. After WW-I, two basic changes occurred that resulted in an economic depression within the subregion. First, the use of coal as home heat was supplanted by oil and natural gas, primarily because the latter two were more convenient to store and use. Secondly, increased mechanization of the coal mining industry resulted in substantial unemployment. For example: "In 1941, coal production amounted to 90 million tons with a total employment of nearly 83,000 miners. By 1964 production had decreased 46% to 48 million tons, but employment fell nearly twice as fast (by 80%) to 16,000 jobs."8/ Unemployment has resulted in inadequate income, education, living standards, and large numbers of persons migrating out of the subregions to areas of greater opportunity. Nevertheless the subregion

---

8/ Regional Development Reconnaissance, PA. State Planning Board, Jan. 1966, p. 4.

has many natural resources and areas of scenic beauty.

Subregion 20

The earliest European settlers in Subregion 20 were French. They recognized the strategic importance of a triangular land area formed by the confluence of the Allegheny and Monongahela rivers at the headwaters of the Ohio River. The French built a military outpost, Fort Duquesne, at the Forks so that they would control access to the Ohio Valley. The Ohio River (and its tributaries) was the highway to the south and to the west. The French were established in Canada and at the mouth of the Mississippi, if they could control the interior they would keep the English behind the Appalachian mountain barrier and win dominion over the Great Valley. The struggle between the French and English ensued for nine years until 1758 when the French were driven out of Fort Duquesne. The English had won control of the interior and Fort Pitt (formerly Duquesne) was to become the eastern most outpost of the vast hinterland that stretched out to the Mississippi.

After the adoption of the federal constitution and the passage of the ordinance for government of the Northwest territory in 1787, the tide of immigration into the west swelled. As the newcomers moved to their future homes in the Ohio Valley, in Kentucky, or in Indiana, they halted at the Forks, where they built or bought their boats and where they acquired supplies and foods. Pittsburgh became the "Gateway to the West."

Since the rivers were the primary network for transportation, boat building in Pittsburgh flourished. The boatyards turned out flatboats, keelboats and barges.

The cheapest and most convenient way to transport goods downstream was by flatboat. A flatboat cost about one dollar a foot and ranged in length from twenty to one hundred feet. On the average a flatboat carried forty to fifty tons of merchandise.

While downstream traffic was carried by flatboats, keelboats were used on upstream hauls. Boatmen walked from bow to stern, pushing long poles against the bottom of the river, thus moving the boat against the current. In 1805, fifty keelboats of thirty ton capacity moved regularly between Pittsburgh and Cincinnati; a decade later there were three times as many. The trip by keelboat from New Orleans to Pittsburgh took four months; down river the 1,950 mile passage took four to six weeks. The river traffic stimulated manufacturing; the factories of Pittsburgh produced goods not only for home consumption but for shipment as well and the expansion of industries brought prosperity to the town. In addition to transportation the rivers powered the mills to make goods. With the invention of the steam engine impetus was given to more efficient manufacturing and transportation. In 1809, the first steam grist mill was established west of the mountains and in 1811, Robert Fulton's firm ordered a steamboat built in a Pittsburgh yard. A year later the first rolling mill powered by a steam engine was working in Pittsburgh.

The combination of rich natural resources and a vast system of waterways enabled Pittsburgh to become an industrial center. Natural resources from the subregion such as lumber, iron and coal, although bulk commodities they could be easily transported by water into Pittsburgh, mills and factories powered by water and steam could produce finished goods that were readily shipped to outside markets. The Appalachian mountain barrier to the east determined that these primary markets would be to the north, west and south of Pittsburgh. Thus, the Ohio River was the main artery leading to these markets.

The transportation barriers that blocked the development of eastern trade helped the growth of industry. The high cost of moving manufactured goods over the mountains from the East offered some local merchants the opportunity to produce them on the spot and thus to profit from the economy of location. A shortage of labor was a drawback, but a steady flow of immigration was to remedy that.

As the population and economy expanded, comunities along the Ohio River developed - McKeesRock, Corapoles, Avalon, Ambridge, Alquippa, Swickley and Rochester. These river valley communities became a series of industrial centers that wind from Pittsburgh to Wheeling, West Virginia. As the frontier moved further west cities such as Cincinnati, Louisville and Saint Louis became trading centers.

Nevertheless, the headwaters of the Ohio enabled Pittsburgh to remain the center through which commerce between the Ohio Valley and the ports on Chesapeake Bay had to pass. In the meantime development of the steam engine, the railroad and steel manufacturing enabled the subregion to shift economic emphasis from trade to manufacturing. The area now focused on the import of raw materials to keep the factories going and the labor force supplied, and the distribution of their finished product. The steel mills and factories that dominated the area were fed by the vast resources of coal, iron, oil and natural gas that were located in the subregion.

The industrial peak was reached between 1870 and 1900. In 1870 the region was producing one-fifth of the Nation's coal, one-third of this coal was converted to coke and used in Pittsburgh's steel mills. By 1900 the Pittsburgh district supplied one-half of the Nation's open hearth steel, two-fifths of all its steel and more than one-half of its coke. This was also the era of the railroad and steel for rails and cars was produced in the region.

After the turn of the nineteenth century the region began a gradual decline. Technological advances in the manufacture of steel, transportation rates, and varying market demands lessened the competitive advantage that Pittsburgh had previously enjoyed. Although production increased, the region's share of the National market decreased. "They had a third of the ingot capacity of the Nation in 1898, a quarter in 1920, a fifth in 1945, and less than a sixth in 1960."9/

Coal mining was also declining. Demand was reduced by the new technology that reduced the amount of coke required to produce steel, and coal was being replaced by oil and gas for home heat. Employment in the mines was further reduced by mechanization.

The loss of National competitive advantage in the steel industry and the subsequent decline in employment precipitated an economic downturn for the subregion. However, the area has abundant natural resources that may once again serve as the basis for regional development.

9/ Pennsylvania's Regions, A Survey of the Commonwealth, Pa. State Planning Board, Jan. 1966, p. 74.

APPENDIX B

TABULAR DATA

Table B-1 Historical and projected acreage of wheat by subregion and State of Pennsylvania

State and Subregion	Historical				Projections					
					Series C			Series E		
	1954	1959	1964	1969	1980	2000	2020	1980	2000	2020
	Thousand acres									
1	6.5	6.5	5.3	3.3	3.3	1.8	1.0	3.2	1.6	0.8
2	39.7	35.7	31.7	19.2	19.4	10.9	6.1	18.5	9.6	4.9
3	45.7	39.0	49.7	31.9	34.9	20.7	11.6	33.3	18.2	9.3
4	8.9	3.7	1.4	1.2	0.4	*	*	0.3	*	*
5	27.2	20.9	15.5	9.8	8.1	3.7	1.8	7.7	3.3	1.4
6	36.9	31.2	27.0	16.3	15.7	8.4	4.5	15.0	7.4	3.6
7	181.0	154.4	147.6	88.6	89.9	50.1	27.4	86.0	44.4	22.1
8	11.7	7.3	4.7	2.2	1.4	0.7	0.2	1.4	0.5	0.2
9	17.1	13.8	10.7	5.6	4.7	1.8	0.7	4.4	1.6	0.6
10	26.1	20.6	17.0	10.4	9.2	4.4	2.2	8.7	3.9	1.8
11	22.2	17.9	14.4	7.3	6.1	2.4	1.0	5.8	2.2	0.8
12	28.3	22.5	19.2	11.8	11.1	5.9	3.1	10.6	5.1	2.5
13	46.3	35.4	30.1	18.7	17.2	8.9	4.6	16.3	7.7	3.6
14	0.1	*	*	*	*	*	*	*	*	*
15	6.9	2.5	3.0	1.4	0.8	0.2	*	0.8	0.2	*
16	25.0	10.8	8.6	4.5	2.4	0.5	0.1	2.3	0.5	0.1
17	30.4	18.4	10.7	6.6	3.6	1.0	0.3	3.4	0.8	0.2
18	26.9	17.0	10.3	5.7	3.1	1.0	0.2	2.9	0.7	0.2
19	20.2	12.4	7.5	3.8	2.0	0.4	*	1.9	0.3	*
20	49.5	30.9	23.7	14.1	9.8	3.6	1.4	9.3	3.1	1.1
State Total	656.7	501.0	438.2	262.5	242.9	126.5	66.5	231.8	111.2	53.2

Source: U.S. Census of Agriculture and U.S. Water Resources Council OBERS Projections.
* Less than 100 acres.

Table B-2 Historical and projected acreage of corn silage by subregion and State of Pennsylvania

State and Subregion	Historical				Projections					
					Series C			Series E		
	1954	1959	1964	1969	1980	2000	2020	1980	2000	2020
	Thousand acres									
1	7.7	7.1	8.7	7.3	6.5	4.9	4.4	6.0	3.4	3.2
2	9.6	7.4	13.3	9.0	9.1	8.3	8.6	8.5	5.7	6.3
3	19.1	15.1	33.1	29.6	35.2	40.9	48.9	32.9	27.9	35.9
4	45.5	35.9	44.8	36.6	29.2	19.5	14.9	27.4	13.3	11.0
5	11.9	10.9	15.0	11.4	10.0	7.5	6.3	9.4	5.1	4.6
6	7.4	6.3	10.7	8.4	8.7	8.5	9.2	8.1	5.7	6.7
7	50.2	43.0	77.5	84.7	96.4	110.9	131.6	90.4	76.5	96.7
8	4.1	3.7	5.5	4.6	4.3	3.9	3.9	4.1	2.6	2.8
9	8.8	7.9	11.3	8.6	8.3	7.3	7.4	7.8	5.0	5.5
10	8.4	7.1	10.3	8.3	7.2	5.5	5.0	6.8	3.8	3.7
11	8.6	8.0	13.9	13.3	14.9	15.5	19.2	14.0	11.3	14.2
12	6.9	6.1	12.0	10.8	12.5	14.0	16.5	11.6	9.2	12.1
13	14.0	11.4	26.1	20.6	24.9	28.0	33.2	23.2	18.5	24.6
14	0.3	0.2	0.3	0.3	0.2	0.2	0.2	0.2	0.1	0.2
15	4.9	4.1	4.4	4.6	3.8	3.2	3.1	3.6	2.2	2.3
16	19.3	14.8	15.8	16.0	12.2	8.7	7.4	11.4	6.0	5.4
17	7.8	6.5	8.0	7.9	6.5	5.2	4.7	6.1	3.5	3.4
18	9.3	7.9	10.4	10.2	8.8	7.2	6.6	8.3	5.0	5.6
19	8.7	7.8	10.6	10.9	10.3	9.6	9.9	9.7	6.6	8.2
20	15.3	10.5	13.5	14.1	11.5	9.6	9.5	10.8	6.6	7.0
State Total	267.8	221.9	345.2	317.3	320.6	318.3	350.4	300.2	217.8	259.4

Source: U.S. Census of Agriculture and U.S. Water Resources Council OBERS Projections.

Table B-3 Historical and projected acreage of corn grain by subregion and State of Pennsylvania

State and Subregion	Historical				Projections					
					Series C			Series E		
	1954	1959	1964	1969	1980	2000	2020	1980	2000	2020
	Thousand acres									
1	15.9	16.7	13.1	13.7	12.6	10.2	9.2	12.7	9.5	7.8
2	73.5	71.6	60.1	58.5	51.1	37.3	30.9	51.4	35.0	26.2
3	88.3	78.9	95.6	105.2	108.9	96.7	89.3	109.5	90.8	75.7
4	9.7	11.9	5.6	13.1	12.0	10.1	9.0	12.0	9.5	7.6
5	32.3	29.8	20.7	23.0	16.4	9.4	6.3	16.5	8.8	5.3
6	52.8	49.6	38.4	38.3	32.0	23.1	19.2	32.2	21.6	16.2
7	276.0	276.6	244.3	247.0	233.0	184.1	160.3	234.0	196.4	135.7
8	14.5	12.0	9.4	8.5	6.2	3.5	2.3	6.2	3.3	2.0
9	22.8	20.7	19.0	18.4	15.6	11.1	9.0	15.7	10.4	7.6
10	36.7	31.9	30.2	28.9	25.1	18.1	14.5	25.2	16.9	12.3
11	35.7	29.9	23.7	22.5	17.5	11.3	8.5	17.6	10.6	7.2
12	41.7	36.6	27.1	25.6	19.2	12.2	9.2	19.4	11.5	7.8
13	65.6	62.8	44.2	45.1	35.2	23.4	18.1	35.6	22.1	15.4
14	*	*	*	*	*	*	*	*	*	*
15	8.0	6.2	5.9	4.8	4.4	3.3	2.9	4.5	3.1	2.5
16	32.9	27.9	23.3	20.8	18.7	14.5	13.1	18.8	13.6	11.1
17	37.6	29.4	23.8	21.0	16.5	10.7	8.1	16.6	10.0	6.9
18	39.7	29.8	25.3	23.3	18.1	11.6	8.8	18.2	10.9	7.4
19	39.3	28.1	22.8	21.4	16.4	10.4	7.9	16.5	9.8	6.7
20	70.2	52.6	44.2	43.9	36.8	26.9	22.7	37.0	25.3	19.3
State Total	993.1	903.2	776.7	782.9	695.9	527.8	449.3	699.6	519.0	380.6

Source: U.S. Census of Agriculture and U.S. Water Resources Council OBERS Projections.
* Less than 100 acres.

Table B-4 Historical and projected acreage of hay by subregion and State of Pennsylvania

State and Subregion	Historical				Projections					
					Series C			Series E		
	1954	1959	1964	1969	1980	2000	2020	1980	2000	2020
	Thousand acres									
1	166.0	153.9	146.8	113.9	106.0	84.5	70.4	98.1	70.7	50.2
2	148.5	140.9	82.5	56.3	49.4	35.5	28.6	45.7	29.6	20.4
3	155.8	149.0	143.2	103.4	105.4	99.4	106.7	97.6	83.2	76.1
4	247.0	244.8	247.9	186.1	178.7	159.8	155.6	165.5	133.7	110.9
5	65.3	63.3	59.6	45.2	44.6	38.9	38.9	41.3	32.5	27.7
6	57.8	60.2	62.2	49.0	54.9	57.9	65.1	50.7	49.0	46.3
7	287.4	299.4	288.5	207.8	224.5	227.5	255.0	208.6	190.8	182.4
8	47.7	44.6	47.0	31.5	30.8	26.8	26.0	28.5	23.2	18.6
9	65.3	66.9	71.9	54.4	58.4	60.5	66.3	54.1	52.4	47.3
10	57.4	58.8	60.4	47.9	51.7	53.4	58.5	47.9	44.7	41.7
11	65.9	77.2	78.9	62.1	72.5	79.5	91.3	67.1	66.8	65.1
12	51.3	60.0	61.2	47.8	58.2	63.7	73.0	53.6	53.1	51.7
13	84.1	96.7	95.9	78.5	90.4	97.2	111.9	83.4	81.1	79.5
14	2.1	2.0	2.2	1.7	1.9	2.0	2.4	1.8	1.7	1.7
15	27.8	28.1	29.1	21.9	24.6	25.1	27.8	22.8	21.0	19.8
16	135.7	129.9	129.6	95.3	100.3	98.8	107.6	92.9	82.7	76.7
17	98.9	94.8	100.4	74.4	80.8	77.5	82.6	74.8	64.8	58.9
18	108.5	102.6	104.2	78.8	80.9	74.6	75.4	74.9	62.4	53.7
19	139.2	135.5	137.8	107.6	114.6	114.7	125.4	106.1	96.0	89.4
20	167.1	151.5	159.1	120.1	125.7	124.5	136.3	116.4	104.1	97.2
State Total	2,178.8	2,160.1	2,108.7	1,585.9	1,654.4	1,601.8	1,704.6	1,531.8	1,343.6	1,215.3

Source: U.S. Census of Agriculture and U.S. Water Resources Council OBERS Projections.

Table B-5 Historical and projected acreage of irish potatoes by subregion and State of Pennsylvania

State and Subregion	Historical				Projections					
					Series C			Series E		
	1954	1959	1964	1969	1980	2000	2020	1980	2000	2020
	Thousand acres									
1	1.8	1.4	1.0	0.8	0.5	0.2	*	0.4	0.1	*
2	10.2	7.0	5.1	3.6	1.8	0.6	0.2	1.7	0.5	0.1
3	5.6	3.9	3.7	2.3	1.4	0.8	0.5	1.3	0.7	0.4
4	0.7	0.5	0.4	0.4	0.2	0.2	*	0.2	0.1	*
5	3.0	2.2	1.8	1.5	1.0	0.5	0.3	0.9	0.4	0.2
6	1.6	1.1	0.9	0.9	0.5	0.3	0.2	0.5	0.2	0.1
7	11.1	7.3	7.8	7.4	5.3	3.2	1.9	4.8	2.6	1.3
8	1.8	1.5	1.9	1.9	1.5	0.9	0.6	1.3	0.7	0.4
9	1.6	1.2	1.0	1.0	0.7	0.5	0.2	0.6	0.4	0.1
10	1.1	0.8	0.4	0.3	0.2	0.2	*	0.2	0.1	*
11	0.7	0.3	0.3	0.2	*	*	*	*	*	*
12	0.3	0.5	0.2	0.1	*	*	*	*	*	*
13	0.7	0.4	0.4	0.4	0.3	0.2	0.1	0.3	0.2	*
14	0.2	0.2	0.2	0.2	0.1	*	*	0.1	*	*
15	2.5	2.0	2.0	1.6	1.1	0.6	0.4	1.0	0.5	0.2
16	4.5	3.5	3.6	2.9	2.1	1.1	0.6	1.9	0.9	0.4
17	0.8	0.6	0.6	0.7	0.5	0.2	0.2	0.5	0.2	0.1
18	2.3	1.9	2.7	3.0	2.2	1.4	1.0	2.0	1.2	0.7
19	1.1	0.6	0.7	0.8	0.5	0.3	0.2	0.4	0.3	0.1
20	1.3	0.9	0.9	0.9	0.6	0.4	0.2	0.5	0.3	0.1
State Total	52.8	37.7	35.3	31.0	20.4	11.5	6.9	18.6	9.4	4.6

Source: U.S. Census of Agriculture and U.S. Water Resources Council OBERS Projections.

* Less than 100 acres.

Table B-6 Historical and projected acreage of vegetables by subregion and State of Pennsylvania

State and Subregion	Historical				Projections					
					Series C			Series E		
	1954	1959	1964	1969	1980	2000	2020	1980	2000	2020
	Thousand acres									
1	1.5	0.9	0.6	0.6	0.5	0.5	0.5	0.5	0.4	0.4
2	14.7	11.9	6.7	5.3	4.1	3.0	2.5	3.9	2.6	1.9
3	11.9	7.6	7.4	5.1	4.7	4.8	4.7	4.5	4.1	3.5
4	1.8	1.6	1.2	1.0	1.0	1.1	1.0	0.9	1.0	0.7
5	7.1	5.1	6.1	8.1	9.5	12.3	12.9	9.0	10.4	9.6
6	2.6	2.1	2.4	3.8	4.6	6.1	6.5	4.4	5.1	4.8
7	29.3	22.7	18.3	14.5	15.4	15.4	14.6	14.6	13.0	10.9
8	1.5	1.3	1.4	0.8	1.0	1.5	2.1	0.9	1.2	1.6
9	2.3	1.9	2.4	2.3	3.0	3.0	4.3	2.8	3.4	3.2
10	1.1	0.8	1.9	1.9	2.7	3.6	4.0	2.6	3.1	2.9
11	2.9	1.0	0.8	0.7	0.5	0.3	0.2	0.5	0.3	0.2
12	1.2	1.1	0.4	0.4	0.3	0.4	0.4	0.3	0.3	0.3
13	3.9	2.8	1.8	1.3	1.1	0.8	0.5	1.0	0.6	0.4
14	0.3	0.2	0.1	*	*	*	*	*	*	*
15	1.6	1.5	2.0	1.8	2.4	3.1	3.4	2.2	2.6	2.5
16	3.9	3.5	3.0	2.9	3.2	4.0	4.2	3.0	3.4	3.1
17	1.1	0.7	0.6	0.7	0.5	0.8	0.9	0.5	0.7	0.7
18	2.6	2.0	1.4	1.3	1.3	1.2	1.2	1.2	1.0	0.9
19	2.1	1.7	1.4	1.3	1.4	1.6	1.6	1.4	1.3	1.2
20	2.8	2.2	2.6	2.5	3.1	4.1	4.0	2.9	3.4	3.0
State Total	96.2	72.6	62.5	56.2	60.1	67.7	69.3	57.2	58.0	51.5

Source: U.S. Census of Agriculture and U.S. Water Resources Council OBERS Projections.
* Less than 100 acres.

Table B-7 Historical and projected acreage of orchards by subregion and State of Pennsylvania

State and Subregion	Historical				Projections					
					Series C			Series E		
	1954	1959	1964	1969	1980	2000	2020	1980	2000	2020
	Thousand acres									
1	3.1	1.2	0.5	0.4	0.3	0.3	0.3	0.3	0.3	0.3
2	6.1	5.2	4.2	3.4	2.5	2.4	2.8	2.5	2.4	2.2
3	10.7	9.4	7.6	6.2	4.3	4.0	4.3	4.3	3.9	3.3
4	7.5	1.5	1.0	0.5	0.2	*	*	0.2	*	*
5	4.3	3.0	0.8	0.5	0.3	*	*	0.3	*	*
6	3.7	3.0	1.7	1.7	1.2	1.2	1.4	1.2	1.2	1.1
7	18.2	22.1	22.7	21.8	19.3	22.3	26.6	19.3	22.1	20.5
8	1.3	0.8	0.6	0.3	0.2	*	*	0.2	*	*
9	1.0	0.8	0.7	0.5	0.3	0.2	0.1	0.3	0.2	*
10	1.9	1.2	0.9	0.5	0.3	0.2	*	0.3	0.2	*
11	3.9	2.8	2.7	1.7	1.0	0.7	0.5	1.0	0.6	0.4
12	2.2	1.9	2.0	1.7	1.3	1.4	1.5	1.3	1.4	1.1
13	17.6	17.3	19.2	19.1	15.4	17.5	20.9	15.4	17.0	15.8
14	*	*	*	*	*	*	*	*	*	*
15	6.3	5.9	6.7	7.0	5.8	6.7	8.0	5.8	7.1	6.1
16	10.0	6.9	7.5	7.2	5.9	6.7	8.1	5.9	6.6	6.1
17	2.2	1.5	1.3	0.8	0.3	0.2	0.1	0.3	0.2	*
18	3.6	2.2	1.6	1.0	0.3	0.2	*	0.3	0.2	*
19	3.7	2.6	1.8	0.9	0.5	0.4	0.4	0.5	0.4	0.3
20	7.1	5.1	4.1	2.4	1.4	0.8	0.9	1.4	0.8	0.7
State Total	114.4	94.5	87.6	77.6	60.8	65.3	76.2	60.8	64.7	58.3

Source: U.S. Census of Agriculture and U.S. Water Resources Council OBERS Projections.
* Less than 100 acres.

Table B-8 Historical and projected numbers of hogs and pigs by subregion and State of Pennsylvania

State					Projections					
and	Historical				Series C			Series E		
Subregion	1954	1959	1964	1969	1980	2000	2020	1980	2000	2020
	Thousands									
1	6.5	4.8	2.5	2.0	1.2	0.3	*	1.2	0.3	*
2	33.1	30.0	22.3	16.9	17.5	12.4	10.3	16.7	10.6	7.6
3	59.3	61.8	51.3	51.7	65.2	58.1	51.0	62.1	49.8	37.9
4	7.0	5.8	2.7	2.5	1.4	0.4	*	1.4	0.4	*
5	20.0	22.8	15.2	15.6	17.2	12.9	9.7	16.7	11.1	7.3
6	31.7	34.7	26.9	34.2	42.4	38.5	33.3	40.4	33.1	24.8
7	145.7	165.7	140.1	203.3	265.4	255.9	227.0	251.2	217.5	166.9
8	10.7	9.9	6.8	5.8	5.3	2.9	1.7	5.0	2.5	1.3
9	12.5	12.5	8.1	7.1	6.5	3.4	1.8	6.2	2.9	1.4
10	18.9	19.1	14.2	16.2	20.3	16.3	13.2	19.0	13.9	9.8
11	28.1	28.6	17.1	16.0	14.1	6.8	3.4	13.4	5.9	2.5
12	28.8	32.1	21.9	20.3	22.2	15.4	11.0	21.5	13.6	8.5
13	39.0	43.3	26.7	29.5	31.3	23.4	18.4	30.7	21.2	14.8
14	*	*	*	*	*	*	*	*	*	*
15	4.4	3.4	1.8	1.5	0.9	0.2	*	0.9	0.2	*
16	21.3	17.6	9.8	9.5	7.0	3.3	1.9	6.7	2.9	1.4
17	28.4	28.3	17.7	15.2	13.7	7.5	4.4	13.0	6.4	3.2
18	30.4	29.0	19.3	18.2	17.3	9.9	6.1	16.4	8.5	4.5
19	29.2	28.7	16.1	14.9	12.7	6.6	3.8	12.1	5.7	2.8
20	49.8	43.0	29.1	30.1	29.0	20.0	14.7	27.6	17.1	10.9
State Total	604.9	621.0	449.7	510.4	590.6	494.4	411.8	562.2	423.5	305.6

Source: U.S. Census of Agriculture and U.S. Water Resources Council OBERS Projections.

* Less than 100 hogs and pigs.

Table B-9 Historical and projected numbers of milk cows by subregion and State of Pennsylvania

State and Subregion	Historical				Projections					
					Series C			Series E		
	1954	1959	1964	1969	1980	2000	2020	1980	2000	2020
	Thousands									
1	35.8	33.0	31.8	23.4	25.9	29.9	36.7	24.7	25.7	27.4
2	33.4	29.9	26.1	19.3	18.9	18.0	19.3	18.0	15.5	14.4
3	80.9	73.9	67.9	59.4	53.2	57.1	67.5	50.7	49.1	50.4
4	110.7	103.7	100.3	82.5	83.0	95.7	118.2	79.1	82.3	88.3
5	27.3	24.2	21.9	16.8	14.6	15.2	17.3	14.0	13.1	12.9
6	24.0	23.1	22.7	19.3	20.5	26.1	34.8	19.5	22.4	26.0
7	146.9	148.8	147.2	138.1	144.3	188.4	253.7	137.5	161.9	189.5
8	15.7	13.7	13.0	10.0	10.3	12.9	17.0	9.8	11.1	12.7
9	27.2	26.8	26.8	21.7	25.6	32.6	43.3	24.4	28.0	32.4
10	23.3	22.2	21.7	18.1	20.4	26.1	34.9	19.4	22.4	26.0
11	31.6	26.3	31.3	26.6	31.5	43.1	59.7	30.0	37.1	44.6
12	25.3	23.3	27.6	25.5	31.0	43.4	60.9	29.6	37.3	45.4
13	40.3	43.1	42.7	38.4	43.7	60.1	83.4	41.6	51.7	62.3
14	0.8	0.7	0.7	0.6	0.7	0.9	1.2	0.7	0.8	0.9
15	14.6	13.9	13.0	10.4	11.9	15.4	20.6	11.3	13.2	15.4
16	61.4	56.9	50.6	38.8	41.4	47.9	59.5	39.4	41.2	44.4
17	32.6	28.8	26.3	19.5	19.6	24.7	32.8	18.7	21.2	24.5
18	38.1	34.9	32.2	24.6	23.6	27.7	34.9	22.5	23.8	26.1
19	46.2	43.3	38.3	28.9	27.3	32.4	41.2	26.0	27.9	30.8
20	59.4	57.0	48.8	37.4	27.9	25.3	25.1	26.5	21.7	18.8
State Total	875.6	827.4	790.9	659.0	675.2	822.8	1,062.2	643.4	707.4	793.3

Source: U.S. Census of Agriculture and U.S. Water Resources Council OBERS Projections.

Table B-10 Historical and projected numbers of cattle and calves by subregion and State of Pennsylvania

State and Subregion	Historical				Projections					
					Series C			Series E		
	1954	1959	1964	1969	1980	2000	2020	1980	2000	2020
	Thousands									
1	58.7	54.1	52.4	43.1	22.8	15.5	10.2	21.6	13.1	7.5
2	65.3	57.0	51.0	40.8	17.8	9.9	6.1	16.9	8.4	4.5
3	163.6	151.4	146.5	137.8	72.0	57.4	48.3	68.5	48.6	35.4
4	188.0	177.7	174.2	154.4	90.4	70.6	54.9	86.0	59.8	40.2
5	51.5	47.5	45.7	39.8	23.3	17.4	14.0	22.2	14.7	10.2
6	52.3	52.8	54.2	52.0	33.1	28.9	26.1	31.4	24.4	19.1
7	349.5	375.6	376.6	401.2	209.1	196.1	176.8	198.9	166.2	129.5
8	33.4	29.9	30.4	25.3	15.9	11.8	9.0	15.1	10.0	6.6
9	51.0	51.7	53.5	48.0	33.0	29.4	25.7	31.4	24.9	18.8
10	46.2	45.6	47.2	44.8	30.1	27.7	24.7	28.6	23.5	18.1
11	67.6	70.4	70.2	63.7	42.9	36.6	30.5	40.8	31.0	22.4
12	51.9	56.0	58.0	56.2	40.5	37.6	33.0	38.5	31.8	24.2
13	85.0	94.6	93.0	94.6	61.3	57.1	50.7	58.3	48.4	37.1
14	1.5	1.4	1.4	1.3	0.8	0.7	0.6	0.8	0.6	0.4
15	29.3	26.6	26.4	22.2	11.7	8.1	5.4	11.1	6.9	4.0
16	128.2	113.5	110.0	91.1	51.7	34.3	22.6	49.1	29.1	16.6
17	73.8	69.1	69.6	56.9	35.7	26.4	19.7	34.0	22.4	14.4
18	86.2	81.3	79.1	65.7	39.8	28.9	21.2	37.8	24.5	12.9
19	113.0	112.2	109.8	90.4	59.5	45.6	35.6	56.5	38.7	26.1
20	160.4	141.7	140.0	116.9	72.4	50.3	36.4	68.9	42.7	26.6
State Total	1,856.5	1,810.3	1,789.0	1,646.2	963.9	790.3	651.6	916.6	669.6	474.6

Source: U.S. Census of Agriculture and U.S. Water Resources Council OBERS Projections.

Table B-11 Historical and projected numbers of chickens by subregion and State of Pennsylvania

State and Subregion	Historical				Projections					
					Series C			Series E		
	1954	1959	1964	1969	1980	2000	2020	1980	2000	2020
	Thousands									
1	506.	463.	364.	326.	277.	269.	282.	266.	232.	212.
2	1,517.	1,264.	1,120.	859.	700.	585.	543.	653.	505.	408.
3	2,162.	2,009.	1,694.	1,374.	1,167.	1,012.	943.	1,118.	874.	708.
4	784.	502.	525.	699.	542.	509.	514.	519.	440.	386.
5	993.	1,024.	896.	540.	482.	398.	363.	462.	344.	273.
6	1,257.	1,271.	1,096.	1,012.	979.	1,004.	1,058.	938.	867.	795.
7	6,268.	6,617.	6,540.	5,854.	5,934.	6,492.	7,119.	5,686.	5,603.	5,348.
8	252.	194.	189.	186.	191.	203.	217.	183.	175.	163.
9	302.	209.	228.	229.	269.	309.	346.	258.	267.	260.
10	607.	521.	354.	340.	276.	259.	262.	264.	224.	197.
11	508.	345.	333.	332.	288.	287.	301.	276.	248.	226.
12	957.	789.	748.	538.	463.	401.	382.	444.	346.	287.
13	957.	812.	630.	468.	348.	245.	193.	333.	212.	145.
14	6.	3.	6.	8.	5.	10.	12.	8.	9.	9.
15	125.	105.	96.	54.	40.	23.	14.	38.	20.	11.
16	569.	411.	346.	236.	170.	125.	109.	163.	108.	82.
17	650.	542.	499.	487.	447.	464.	499.	428.	401.	375.
18	710.	579.	588.	626.	597.	636.	678.	572.	549.	509.
19	732.	612.	518.	401.	313.	243.	204.	300.	210.	153.
20	912.	740.	868.	801.	787.	854.	924.	755.	737.	694.
State Total	20,774.	19,013.	17,637.	15,368.	14,275.	14,330.	14,964.	13,664.	12,368.	11,243.

Source: U.S. Census of Agriculture and U.S. Water Resources Council OBERS Projections.

Table B-12 Historical and projected numbers of broilers by subregion and State of Pennsylvania

State and Subregion	Historical				Projections					
					Series C			Series E		
	1954	1959	1964	1969	1980	2000	2020	1980	2000	2020
	Thousands sold									
1	2,127.	1,536.	268.	143.	27.	1.	*	24.	1.	*
2	902.	496.	210.	140.	127.	72.	52.	112.	62.	39.
3	2,950.	2,767.	2,037.	3,548.	3,505.	2,329.	1,886.	3,094.	2,003.	1,410.
4	765.	1,591.	1,339.	540.	1,022.	661.	612.	902.	569.	458.
5	781.	945.	888.	1,183.	1,875.	1,656.	1,626.	1,653.	1,424.	1,216.
6	1,550.	2,855.	3,122.	4,120.	1,632.	6,556.	6,574.	6,205.	5,637.	4,917.
7	9,951.	11,654.	13,498.	27,661.	42,062.	40,877.	41,413.	37,371.	35,147.	30,968.
8	192.	758.	830.	718.	2,066.	2,155.	2,276.	1,824.	1,853.	1,702.
9	378.	950.	675.	233.	322.	109.	43.	285.	94.	32.
10	623.	1,133.	1,422.	1,231.	2,382.	2,126.	2,099.	2,106.	1,828.	1,569.
11	349.	582.	602.	30.	637.	662.	697.	563.	569.	521.
12	1,726.	2,227.	2,849.	2,395.	4,522.	3,665.	3,399.	3,979.	3,151.	2,541.
13	963.	1,460.	1,792.	1,517.	4,863.	4,654.	4,778.	4,076.	4,001.	3,573.
14	18.	44.	13.	*	*	*	*	*	*	*
15	23.	10.	9.	2.	*	*	*	*	*	*
16	499.	941.	220.	15.	140.	62.	32.	124.	53.	24.
17	324.	430.	468.	10.	70.	77.	83.	61.	66.	62.
18	552.	1,038.	1,615.	1,032.	2,257.	2,316.	2,432.	1,993.	1,992.	1,819.
19	312.	165.	53.	27.	7.	4.	20.	7.	4.	15.
20	830.	573.	102.	72.	24.	10.	36.	21.	8.	27.
State Total	25,817.	32,156.	32,013.	44,614.	67,543.	67,993.	68,057.	64,401.	58,461.	50,892.

Source: U.S. Census of Agriculture and U.S. Water Resources Council OBERS Projections.
* Less than 1,000 broilers.

Table B-13 Historical and projected numbers of sheep and lambs by subregion and State of Pennsylvania

State and Subregion	Historical				Projections					
					Series C			Series E		
	1954	1959	1964	1969	1980	2000	2020	1980	2000	2020
	Thousands									
1	2.3	2.0	1.4	1.6	0.5	0.5	0.6	0.5	0.4	0.4
2	4.9	4.5	5.0	2.9	1.3	1.4	1.9	1.2	1.2	1.3
3	12.7	11.9	11.8	8.3	3.6	4.2	4.9	3.3	3.4	3.4
4	11.2	14.3	11.1	12.0	5.7	8.0	10.6	5.3	6.4	7.3
5	13.2	15.6	2.7	2.4	0.4	0.3	0.4	0.4	0.3	0.3
6	17.9	5.0	3.1	3.2	0.5	0.5	0.7	0.5	0.4	0.5
7	22.8	24.7	25.9	20.8	10.4	14.6	19.3	9.8	11.7	13.2
8	3.5	3.7	2.3	1.9	0.9	1.2	1.6	0.8	1.0	1.1
9	10.6	11.5	4.5	4.4	1.7	2.2	2.9	1.6	1.7	2.0
10	15.1	16.0	2.4	3.1	0.6	0.5	0.7	0.5	0.4	0.5
11	5.7	6.4	3.8	3.4	1.3	1.2	1.2	1.2	0.9	0.8
12	15.3	18.5	3.3	2.8	0.5	0.3	0.2	0.5	0.2	0.1
13	5.9	7.0	5.3	4.5	1.8	1.9	2.1	1.7	1.6	1.5
14	0.3	0.3	0.2	0.2	*	*	*	*	*	*
15	1.5	1.5	1.2	0.7	0.2	0.2	0.1	0.2	0.1	*
16	10.8	12.2	9.3	7.8	3.3	3.8	4.5	3.1	3.0	3.1
17	4.9	6.6	5.2	6.4	3.1	4.6	6.2	2.9	3.7	4.1
18	7.0	7.7	6.9	7.3	3.3	4.9	6.4	3.1	3.9	4.4
19	56.0	48.7	46.0	40.8	16.7	19.5	22.3	15.6	15.7	15.3
20	46.1	41.6	38.6	35.0	14.6	17.7	20.8	13.7	14.2	14.3
State Total	267.7	259.7	190.1	169.3	70.4	87.4	107.4	65.9	70.4	73.5

Source: U.S. Census of Agriculture and U.S. Water Resources Council OBERS Projections.
* Less than 100 sheep and lambs.

Table B-14 Historical and projected numbers of turkeys by subregion and State of Pennsylvania

State and Subregion	Historical				Projections					
					Series C			Series E		
	1954	1959	1964	1969	1980	2000	2020	1980	2000	2020
	Thousands sold									
1	59.6	49.9	155.5	53.2	85.3	101.3	106.8	81.4	87.2	80.0
2	274.6	213.8	460.4	374.4	602.5	715.3	754.2	574.5	615.5	564.8
3	380.3	319.9	374.4	595.4	958.3	1,137.8	1,199.7	913.8	979.0	898.5
4	76.8	28.1	15.3	23.8	27.4	31.4	34.6	26.1	27.0	25.9
5	71.2	47.2	23.8	22.2	23.6	26.1	27.1	22.5	22.5	20.3
6	101.4	103.0	119.3	69.2	84.5	80.9	76.9	80.6	69.6	57.5
7	605.7	438.4	419.8	680.2	1,082.6	1,287.5	1,358.7	1,032.3	1,107.8	1,017.5
8	39.8	24.3	14.2	8.4	4.6	1.3	0.4	4.5	1.1	0.3
9	21.9	16.0	8.5	2.5	6.6	3.2	1.7	6.2	2.8	1.3
10	33.1	23.4	6.8	14.0	9.0	7.9	7.7	8.6	6.8	5.7
11	76.0	27.7	19.5	27.6	15.1	7.7	4.0	14.4	6.6	3.0
12	57.2	21.3	10.3	4.4	2.3	1.4	1.1	2.2	1.2	0.9
13	176.3	57.3	59.8	107.3	118.3	142.8	151.5	112.8	122.9	113.3
14	*	*	*	*	*	*	*	*	*	*
15	10.3	10.5	14.8	12.5	18.8	22.7	26.9	18.0	19.5	20.1
16	59.5	43.1	46.5	36.1	52.2	57.7	61.8	49.8	49.6	46.3
17	44.2	36.8	19.6	11.2	6.2	1.3	0.3	5.9	1.1	0.2
18	109.9	68.2	42.6	46.2	46.3	49.4	56.6	44.1	42.5	42.4
19	78.1	45.6	27.8	30.5	32.3	35.2	40.3	30.8	30.3	30.1
20	85.5	55.7	23.3	18.4	13.5	9.8	8.7	12.9	8.4	6.5
State Total	2,361.4	1,630.1	1,862.2	2,137.6	3,189.5	3,720.7	3,919.0	3,041.3	3,201.4	2,934.5

Source: U.S. Census of Agriculture and U.S. Water Resources Council OBERS Projections.
* Less than 100 turkeys.

Table B-15 Historical and projected number of farms by subregion and State of Pennsylvania

State and Subregion	Historical				Projections					
					Series C			Series E		
	1954	1959	1964	1969	1980	2000	2020	1980	2000	2020
	Thousands									
1	3.6	2.6	2.0	1.4	1.1	0.8	0.6	1.1	0.7	0.4
2	6.4	4.7	3.7	2.7	2.0	1.3	1.0	1.9	1.1	0.7
3	11.2	8.2	6.9	5.4	4.4	3.4	2.7	4.2	2.9	2.0
4	7.6	5.9	5.3	4.2	3.4	2.7	2.2	3.2	2.3	1.6
5	4.8	3.8	2.8	2.2	1.8	1.3	1.0	1.7	1.1	0.7
6	4.5	3.7	3.0	2.4	2.1	1.7	1.4	1.9	1.4	1.0
7	21.6	19.7	16.0	13.3	11.8	10.0	8.4	11.2	8.5	6.3
8	3.5	2.3	1.9	1.1	0.9	0.5	0.4	0.8	0.4	0.3
9	2.5	2.0	2.0	1.6	1.3	1.0	0.8	1.2	0.8	0.6
10	3.5	2.8	2.3	1.9	1.6	1.2	1.0	1.5	1.1	0.7
11	4.5	3.4	2.9	2.0	1.7	1.3	1.0	1.6	1.1	0.8
12	3.8	3.0	2.5	2.0	1.7	1.4	1.1	1.6	1.2	0.8
13	5.1	4.4	3.6	2.9	2.6	2.1	1.8	2.4	1.8	1.3
14	*	*	*	*	*	*	*	*	*	*
15	2.1	1.5	1.4	1.0	0.9	0.6	0.5	0.8	0.6	0.4
16	9.0	6.5	5.4	3.8	2.9	1.9	1.4	2.7	1.6	1.0
17	6.5	4.9	4.1	2.4	1.9	1.3	1.0	1.8	1.1	0.7
18	7.4	5.1	4.4	3.0	2.3	1.6	1.2	2.2	1.4	0.9
19	9.2	6.6	5.5	3.8	3.0	2.2	1.7	2.9	1.8	1.2
20	11.9	8.8	7.4	5.6	4.5	3.3	2.5	4.2	2.8	1.9
State Total	128.9	100.1	83.1	62.8	51.7	39.4	31.4	48.8	33.7	23.3

Source: U.S. Census of Agriculture.
* Less than 100 farms.

Table B-16 Historical and projected acreage of land in farms by subregion and State of Pennsylvania

State and Subregion	Historical				Projections					
					Series C			Series E		
	1954	1959	1964	1969	1980	2000	2020	1980	2000	2020
	Thousand acres									
1	433.	390.	324.	240.	222.	185.	154.	210.	158.	115.
2	554.	477.	411.	337.	297.	246.	203.	280.	210.	151.
3	909.	797.	725.	617.	582.	531.	476.	549.	454.	354.
4	1,146.	1,068.	1,087.	894.	871.	821.	749.	822.	702.	557.
5	467.	416.	349.	296.	274.	240.	208.	258.	205.	155.
6	446.	430.	375.	323.	318.	303.	280.	300.	259.	208.
7	1,767.	1,699.	1,577.	1,384.	1,382.	1,350.	1,259.	1,304.	1,154.	936.
8	378.	313.	281.	207.	177.	135.	104.	167.	115.	77.
9	354.	329.	378.	305.	292.	272.	244.	276.	232.	181.
10	408.	374.	329.	288.	271.	248.	221.	255.	212.	164.
11	596.	556.	494.	381.	370.	334.	297.	350.	285.	221.
12	473.	444.	401.	325.	320.	294.	271.	302.	255.	201.
13	628.	613.	550.	482.	479.	465.	433.	452.	398.	322.
14	18.	16.	13.	11.	10.	8.	7.	9.	7.	5.
15	200.	173.	163.	135.	125.	113.	101.	118.	97.	75.
16	983.	837.	729.	578.	503.	403.	325.	474.	345.	241.
17	667.	581.	526.	411.	369.	308.	254.	349.	263.	189.
18	695.	595.	526.	422.	381.	321.	269.	359.	274.	200.
19	897.	810.	721.	575.	542.	476.	413.	511.	407.	307.
20	1,082.	943.	845.	687.	633.	548.	471.	597.	469.	350.
State Total	13,102.	11,862.	10,804.	8,901.	8,417.	7,605.	6,739.	7,944.	6,501.	5,008.

Source: U.S. Census of Agriculture and U.S. Water Resources Council OBERS Projections.